



2021 319 Application Form

General Information

Project Name Lolo Creek Stream Restoration

Sponsor Name Lolo Watershed Group

Registered with the Secretary of State? ☒ ☐

Registered with SAM? ☒ ☐

Duns # 079251276

Does your organization have liability insurance? ☒ ☐

Primary Contact Heather Brighton

Signatory Travis Ross

Title Watershed Coordinator/Contractor

Title President of Lolo Watershed Group

Address P.O. Box 1354

Address 301 W. Alder

City Lolo State ☒ ☐ Zip Code 59847

City Missoula State ☒ ☐ Zip Code 59802

Phone Number (406) 531-8657

Phone Number (406) 258-4964

Email Address heather@lolowatershed.org

Email Address travis@missoulacounty.us

Signature Heather Brighton

Signature Travis Ross

Technical and Administrative Qualifications

The Lolo Watershed Group (LWG) is comprised of volunteer board members each of whom bring a unique skill set to the work of the organization. In addition to the board of directors, the LWG has an advisory board, whose members supplement the knowledge of the board of directors with various technical and scientific expertise. This past August, LWG hired Heather Brighton as their new coordinator. Heather formally worked for Trout Unlimited as a project manager and has successfully applied for and managed DEQ 319 grants for the Ninemile and Bitterroot watersheds. Please see Attachment A for a list of board members and advisory board members as well as their current professions and roles within the conservation and natural resource fields.

Past Projects

Project Name	Grant or Contract Amount	Funding Entity (entity name/program, contact person, phone, email)	Completion Date
Returning Lolo Creek to a Natural State - Design	\$ 40,000.00	Department of Environmental Quality, 319 grant, Eric Trum	Ongoing
Lolo Watershed Capacity Support	\$ 28,000.00	Department of Natural Resources and Conservation, Watershed Management Grant, Jorri Dyer.	Ongoing
Riparian Vegetation Restoration at John Creek	\$ 7,400.00	Montana Watershed Coordination Council, Terri Nichols	Completed November 3, 2020

Budget Summary*

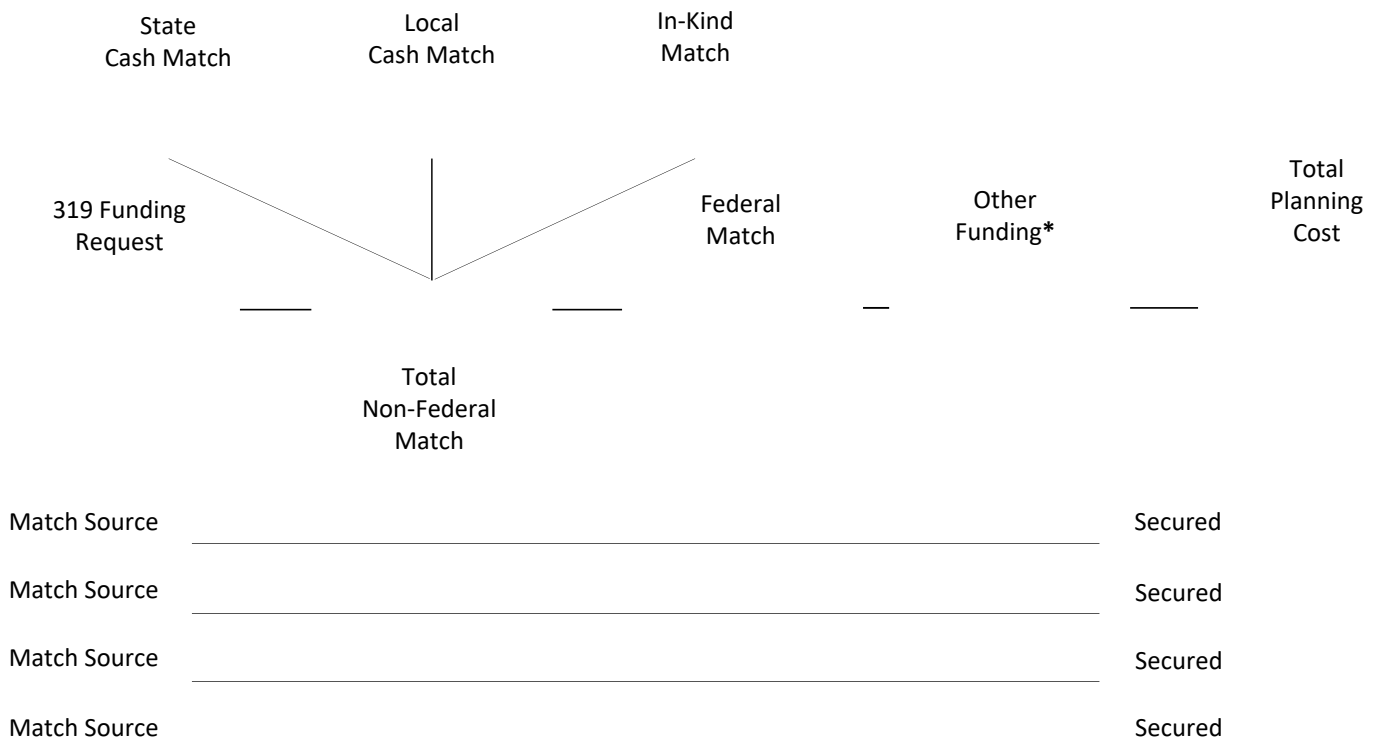
		Other Funding	Federal Match	Non-Federal Match	319 Funding Request	Total Cost
	Education and Outreach					
	Project Administration					
	Total					
	Project 1 Name					
Project 1	Project Planning					
	Landowner Agreements, O & M					
	Project Implementation					
	Other Activities					
	Project Effectiveness Monitoring					
	Total					
	Project 2 Name					
Project 2	Project Planning					
	Landowner Agreements, O & M					
	Project Implementation					
	Other Activities					
	Project Effectiveness Monitoring					
	Total					
	Project 3 Name					
Project 3	Project Planning					
	Landowner Agreements, O & M					
	Project Implementation					
	Other Activities					
	Project Effectiveness Monitoring					
	Total					
	Total					

*Fields outlined in black on this page will auto-populate from other sections of the application form. Fields outlined in red on this page will not auto-populate. You must manually transfer the information for fields outlined in red.

Education and Outreach

DEQ recognizes that developing good projects often requires a considerable amount of time and effort up front to build relationships and trust with individual landowners and stakeholder groups. To promote the development of future projects, DEQ is encouraging project sponsors to use up to \$5,000 in 319 funding for education and outreach to develop and capitalize on these critical relationships. DEQ encourages applicants to incorporate on-the-ground projects into education and outreach efforts through on-site demonstrations and project tours. 319 funding may not be used to pay for food and beverages, or for honorariums and gifts. Education and outreach activities funded by 319 or used as match for 319 funding must adhere to all of the eligibility requirements outlined in the annual Call for Applications document.

Education and Outreach Deliverables *(Identify the education and outreach activities you will engage in and methods you will use to document their completion.)*



**Use this space to record any funding that will be used to support creation of the task deliverables, but will not be reported as match. The purpose of this information is to give application reviewers a clearer understanding of the total amount of funding required to complete a task.*

Project Administration

Project administration includes book keeping, invoicing, interim/annual/final report preparation, office supplies, rent, communications, etc. Up to 10% of the total requested 319 funds for your entire application can be used to pay for project administration. However, like all other tasks, payment is by reimbursement for actual expenses incurred.

Project Administration Deliverables *(Include interim/mid-year, annual, and final reports, as well as invoicing and office necessities.)*

State Cash Match	Local Cash Match	In-Kind Match	Federal Match	Other Funding*	Total Planning Cost
319 Funding Request	Total Non-Federal Match				
Match Source					Secured
Match Source					Secured
Match Source					Secured
Match Source					Secured

**Use this space to record any funding that will be used to support creation of the task deliverables, but will not be reported as match. The purpose of this information is to give application reviewers a clearer understanding of the total amount of funding required to complete a task.*

Project Form

A separate Project Form (***including providing separate attachments***) must be submitted for each project included in your application. Use the following examples to help determine when to lump and when to split projects. For additional assistance, contact Mark Ockey at mockey@mt.gov.

Splitting Examples (fill out multiple Project Forms)

- Stream restoration work occurring on two separate streams, on parcels owned by two separate individuals
- Two projects with significantly different sets of project partners
- Two projects that address substantially different pollution sources (e.g., one project that moves a corral off of a stream, and another to remove mine tailings, with both projects being on the same 800-acre recreational property)

Lumping Examples

- Contiguous stream restoration work spanning multiple land parcels
- 3 projects that address similar sources of pollution on a single land parcel (e.g., moving a corral off a stream, implementing a grazing management plan, and relocating a manure storage facility out of the floodplain, all on the same ranch)
- A mini-grant program designed to address numerous failing septic systems scattered throughout a watershed

Project Name _____**Project Location**

Latitude _____ Longitude _____

Latitude _____ Longitude _____

Latitude _____ Longitude _____

12-digit HUC(s) # _____

Project site map attached, showing the location of all proposed on-the-ground restoration**Project Planning and Purpose**

Select the Watershed Restoration Plan that your project will help implement.

Letter of support from author entity attached? *(if no, explain why below.)*

Waterbody name from the 2018 List of Impaired Waters _____

Probable causes of impairment to be addressed _____

Waterbody name from the 2018 List of Impaired Waters _____

Probable causes of impairment to be addressed _____

or*

Name of healthy waterbody to be protected _____

Description of identified threat to non-impairment status

Name of healthy waterbody to be protected _____

Description of identified threat to non-impairment status

**While the majority of the available 319 project funding is dedicated to addressing known impairments, EPA is allowing states to use a limited amount of funding to protect non-impaired waters (healthy waters) from becoming impaired.*

Community Participation and Support

Landowner	Contributions to Project	Letter of Support Attached?
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Partner	Role	Letter of Support Attached?
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Other Community/Stakeholder Support

Project Description

Describe the nature and extent of the nonpoint source problem you are trying to address, the root causes of the problem, and your proposed solution.

Is this project a continuation of a previous project? If so, please explain the connection.

Tasks and Budget

DEQ uses a standard template to develop scopes of work for 319 contracts. The tasks below match up with DEQ standard scope of work template. Some tasks might not be applicable to your project. Please leave the non-applicable tasks blank. If your project doesn't fit the task outline, use the task labeled "Other" to describe your project.

Task 1 - Project Planning Deliverables *(Include such things as completing project designs, conducting site evaluations, obtaining permits, organizing volunteers, conducting scoping meetings, etc. Identify specific deliverables that will be submitted.)*

State
Cash Match

Local
Cash Match

In-Kind
Match

319 Funding
Request

Federal
Match

Other
Funding*

Total
Planning
Cost

Total
Non-Federal
Match

Match Source

Secured

Match Source

Secured

Match Source

Secured

Match Source

Secured

**Use this space to record any funding that will be used to support creation of the task deliverables, but will not be reported as match. The purpose of this information is to give application reviewers a clearer understanding of the total amount of funding required to complete a task.*

Landowner Agreements, Operation and Maintenance

This task only applies to projects involving on-the-ground activities. DEQ periodically evaluates the effectiveness of each on-the-ground project. To accomplish this, DEQ requires a process be in place to allow periodic access to the project site. The landowner agreement should also specify the roles of each project partner in the design, implementation and continued operation of on-the-ground pollution prevention practices. DEQ does not require the use of a specific landowner agreement template. In some situations, existing agreements between the project sponsor and the landowner may be sufficient.

Task 2 - Landowner Agreements, Operation and Maintenance Deliverables *(Include such things as landowner/sponsor communication, and draft and final agreements.*

State
Cash Match

Local
Cash Match

In-Kind
Match

319 Funding
Request

Federal
Match

Other
Funding*

Total
Planning
Cost

Total
Non-Federal
Match

Match Source

Secured

Match Source

Secured

Match Source

Secured

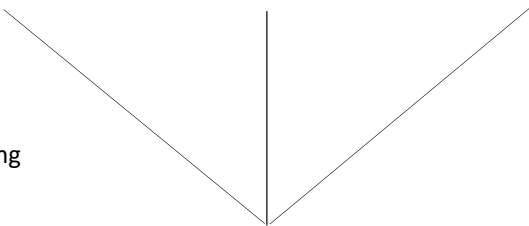
Match Source

Secured

**Use this space to record any funding that will be used to support creation of the task deliverables, but will not be reported as match. The purpose of this information is to give application reviewers a clearer understanding of the total amount of funding required to complete a task.*

Project Implementation

Task 3 - Project Implementation Deliverables *(Include such things as construction oversight, implementation of on-the-ground restoration practices, preparation and submittal of as-built drawings, etc.)*

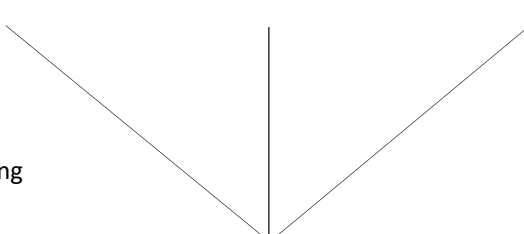
	State Cash Match	Local Cash Match	In-Kind Match				
							
319 Funding Request				Federal Match	Other Funding*	Total Planning Cost	
<hr/>							
Total Non-Federal Match							
Match Source	<hr/>					Secured	
Match Source	<hr/>					Secured	
Match Source	<hr/>					Secured	
Match Source	<hr/>					Secured	

**Use this space to record any funding that will be used to support creation of the task deliverables, but will not be reported as match. The purpose of this information is to give application reviewers a clearer understanding of the total amount of funding required to complete a task.*

Other Activities

Use this task if the activities you are proposing are outside the scope of the typical design/implement/monitor process. Provide sufficient details to enable application reviewers to successfully compare the nonpoint source pollution reduction benefits of your project to those of other projects in the applicant pool.

Task 4 - Project Deliverables *(Include activities you will complete and the products you will submit to demonstrate completion.)*

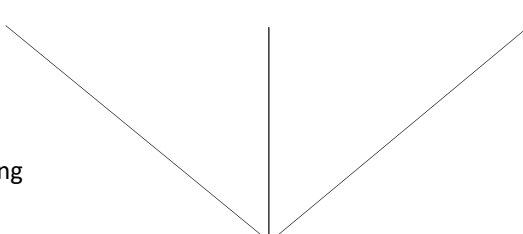
State Cash Match	Local Cash Match	In-Kind Match		
			Federal Match	Other Funding*
319 Funding Request	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border-top: 1px solid black; width: 40%;"></div> <div style="border-top: 1px solid black; width: 40%;"></div> </div>			Total Planning Cost
<div style="display: flex; justify-content: space-between;"> <div style="width: 20%;"></div> <div style="width: 40%; text-align: center;">Total Non-Federal Match</div> <div style="width: 20%;"></div> <div style="width: 20%;"></div> </div>				
Match Source				Secured
Match Source				Secured
Match Source				Secured
Match Source				Secured

**Use this space to record any funding that will be used to support creation of the task deliverables, but will not be reported as match. The purpose of this information is to give application reviewers a clearer understanding of the total amount of funding required to complete a task.*

Project Effectiveness Monitoring

The short duration (1-3 years) and limited spatial extent (often just a few hundred yards) of most 319-funded projects frequently precludes the use of traditional water chemistry monitoring as a means of evaluating project effectiveness. Instead, DEQ encourages project sponsors to use simpler, more qualitative tools. Typically, this will include pre- and post-construction photo point monitoring, vegetation mortality measurements, and perhaps modeling to estimate pollution load reductions. Please contact one of the DEQ Nonpoint Source Program staff for guidance relative to your specific project.

Task 5 - Project Effectiveness Monitoring Deliverables *(Identify the specific tools and products you will use to evaluate and demonstrate the effectiveness of your project in reducing nonpoint source pollution.)*

State Cash Match	Local Cash Match	In-Kind Match	Federal Match	Other Funding*	Total Planning Cost
					
319 Funding Request	Total Non-Federal Match				
Match Source					Secured
Match Source					Secured
Match Source					Secured
Match Source					Secured

**Use this space to record any funding that will be used to support creation of the task deliverables, but will not be reported as match. The purpose of this information is to give application reviewers a clearer understanding of the total amount of funding required to complete a task.*

Water Quality Benefits and Sustainability

Explain why the project is an appropriate next step for making progress towards removing a pollutant/waterbody combination from Montana's 2018 Impaired Waters List or preventing a healthy waterbody from becoming impaired?

Will your project address a major local source of nonpoint source pollution? Explain.

Describe the long-term, sustainable benefits your project will have on water quality.

Explain how your project will promote self-maintaining natural, ecological, and social processes that protect water quality.

Nonpoint Source Goals and Success Metrics

Nonpoint source pollution goal	Action that will be taken to reach the goal	Metric used to measure success
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Project Education and Outreach

Describe the educational benefits of your project. Will the project inspire additional nonpoint source pollution prevention work within the watershed?

Bigger Picture Benefits

Describe your project's benefits to each of the items below. If there are no associated benefits, type "NA" for "not applicable".

Benefit to additional natural resources (e.g. native fisheries, threatened and endangered species, wetlands, etc).

Addressing climate resiliency and hazard mitigation.

Provides direct public recreational access or aesthetic benefit.

Reduces pollutant loading above a permitted point source in a manner that could contribute to future economic benefit for a downstream Montana community.

Directly helps protect a drinking water source.

Benefit to socially disadvantaged populations.

Additional Attachments

Attach additional items that could help reviewers better understand your project. Items could include site photos, design drawings, site evaluations, permits, etc. Please be conscious of reviewers' time, as they may not have time to read lengthy studies and reports. List all additional attachments below.

Appendix

Letters of Support

Preliminary Design

Preliminary Budget

Maps

October 18, 2019

TO: Kascie Herron
Lolo Watershed Group
P.O. Box 1354
Lolo, MT 59847

FROM: Marie Ann Zens Kimerly
17155 Lolo Creek Road
Lolo, MT 59847

RE: Letter of Support for Reducing Sediment and Promoting a Healthy Lolo Creek

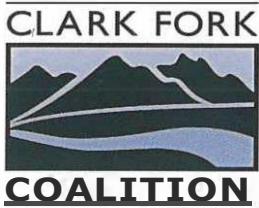
I am a landowner on approximately 3,300 feet of Lolo Creek. I would like to support improvements to water quality, fisheries habitat, riparian condition and stream channel stability on this reach of Lolo Creek. Conserving fish and wildlife habitat is important to my land management.

The Lolo Creek Sediment Reduction Project led by Lolo Watershed Group (LWG) is proposing restoration along the entirety of Lolo Creek through my property, but in a phased approach. This specific project aims to prioritize the lower stretch of creek, by allowing for natural floodplain reconnection and channel meandering that historically moved freely during high and low water events. This project would reduce fine sediments, increase connectivity, enhance aquatic habitat and increase ecological function of the riparian and floodplain corridor. I support this project and will coordinate with LWG, DEQ, Fish Wildlife and Parks, and contractors on granting permission for access to the site.

Thank you,



Marie Ann Zens Kimerly



RE: Letter of support for the Lolo Watershed Group DEQ 319 Nonpoint Source Fall 2020 funding application

To Whom It May Concern:

I am writing on behalf of the Clark Fork Coalition in support of the Lolo Watershed Group's application for 319 nonpoint source funding to design and implement projects along the creek to address the negative impacts of sediment on the creek.

The Lolo Watershed Group has been active in the community for nearly 15 years, implementing various planting projects each year for the past five years on private property. The proposed larger scale channel restoration project will be a positive step forward for Lolo Creek and the LWG in their mission to restore and protect the watershed.

In addition to implementing projects, the LWG has conducted extensive outreach to the local community, including agency partners like the Forest Service, as well as private landowners along the creek. They have proven themselves to be a reliable partner, and an organization that accomplishes quite a lot with very few resources.

As an advisory board member for the LWG and PM for the Clark Fork Coalition, I support their application for 319 funding to continue addressing nonpoint sources of pollution into Lolo Creek, and implementing projects that improve water quality.

Sincerely,

A handwritten signature in black ink, appearing to read "Jed Whiteley". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Jed Whiteley
Project Manager, Clark Fork Coalition

PO Box 7593
Missoula, MT 59807

T: 406.542.0539
F: 406.542.5632

www.clarkfork.org



November 9th, 2020

Hanna Reidl
Water Quality Planning Bureau
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Dear Ms. Reidl,

I am writing in support of the Lolo Watershed Group's application for 2020 319 nonpoint source funding for implementation of their Lolo Creek Sedimentation Reduction Project on the Zen ranch. The Lolo Watershed Group has been active in the community for nearly 15 years. Over the past five years, their restoration focus has centered on successfully implementing various riparian and post-fire planting projects on private property. The shift in focus to this larger scale channel restoration project will be a positive step forward for Lolo Creek and a full realization of LWG's mission to restore and protect the watershed.

In addition to implementing projects, the LWG has conducted extensive outreach to the local community, including agency partners like the Forest Service, as well as private landowners along the creek. They have proven themselves to be a reliable partner, and an organization that accomplishes quite a lot with very few resources.

Lolo Creek is classified as impaired due to sedimentation. The Lolo Creek Watershed Restoration Plan focuses on opportunities for improving cold-water fisheries, habitat for aquatic life, and the reduction of sedimentation. The Lolo Creek Sediment Reduction Project proposes restoration of 3300' of Lolo Creek through the Zen ranch; a ranch that has been in the same family for three generations. This project is broken up into three phases, with the first phase prioritizing the lower stretch of the creek. The goals of this phase are to allow for natural floodplain reconnection, restore channel form by increasing meandering, and narrowing the channel to a more natural width/depth ratio. This project would reduce fine sediments, increase connectivity, enhance aquatic habitat and increase ecological function of the riparian and floodplain corridor.

The main stem of Lolo Creek has been significantly modified but traditionally supported high water quality and a great fishery. The proposed project is one major opportunity to restore more natural stream, riparian, and wetland function to a significant reach by partnering with a private landowner. Partnerships with private landowners are elusive and often beyond the scope of work that can be pursued by agencies such as the Forest Service, yet they often provide great benefit to the resource and the community. If this project is implemented successfully, it may generate other, similar opportunities on adjacent properties. In that context, it is a significant opportunity that warrants strong consideration for funding.



As a proponent of Lolo Creek restoration and a steward of Western Montana's waters, I give my full support for Lolo Watershed Group's Lolo Creek Sediment Reduction Project, Phase I.

Sincerely,

/s/ Traci Sylte

Traci L. Sylte
Fish, Water, and Soils Program Manager
Lolo National Forest



Region 2 Headquarters
3201 Spurgin Road
Missoula, MT 59804
Phone 406-542-5500
October 16, 2019

Water Quality Planning Bureau
Attn: Hannah Riedl
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Dear Ms. Riedl:

Please accept this letter of support for Lolo Watershed Group's funding application related to stream enhancement work on main stem Lolo Creek near Missoula. The application requests funding under the Clean Water Act Section 319 Nonpoint Source (NPS) Program administered by the Department of Environmental Quality (DEQ).

The main stem of Lolo Creek is a highly modified, main stem stream reach that traditionally supported high water quality and a great fishery. The proposed project involves one major opportunity to restore more natural stream, riparian, and wetland function to a significant reach on private property. If this project is implemented successfully, it may generate other, similar opportunities on adjacent properties. In that context, it is a significant opportunity that warrants strong consideration for funding.

Please give Lolo Watershed Group's application strong consideration and feel free to contact me if you would like more information related to aquatic resources in the Lolo Creek watershed.

Sincerely,

William Ladd Knotek
Fisheries Management Biologist

LOLO CREEK - ZENS RESTORATION PROJECT

30% PRELIMINARY DESIGN

PROJECT PARTNERS:



307 STATE ST.
HAMILTON, MT 59840
406.363.2353



236 WISCONSIN AVE.
WHITEFISH, MT 59937
406.862.4927



PO BOX 1354
LOLO, MT 59847

ZENS
FAMILY



PROJECT DESCRIPTION:

LOLO CREEK IS A TRIBUTARY TO THE BITTERROOT RIVER LOCATED NEAR LOLO, MONTANA. LOLO CREEK AND MANY OF ITS TRIBUTARIES ARE LISTED AS IMPAIRED WATERBODIES BY THE MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ). UPPER AND MIDDLE LOLO CREEK ARE ON THE 303(D) LIST FOR SEDIMENT AND TOTAL MAXIMUM DAILY LOAD (TMDL) VALUES HAVE BEEN DEVELOPED AS TARGETS FOR SEDIMENT DELIVERY TO THE STREAM.

IN 2013, THE LOLO WATERSHED GROUP (LWG) AND PARTNERS COMPLETED THE *LOLO CREEK WATERSHED RESTORATION PLAN* (WRP). THE PURPOSE OF THE LWG'S WRP WAS TO DEVELOP A 5-10 YEAR PLAN TO ACHIEVE CONSERVATION AND RESTORATION GOALS IN THE LOLO CREEK WATERSHED. THE WRP DESCRIBES THE FOLLOWING AS PRIMARY ISSUES FOR FISHERIES, WILDLIFE AND WATER/QUALITY QUANTITY IN THE WATERSHED:

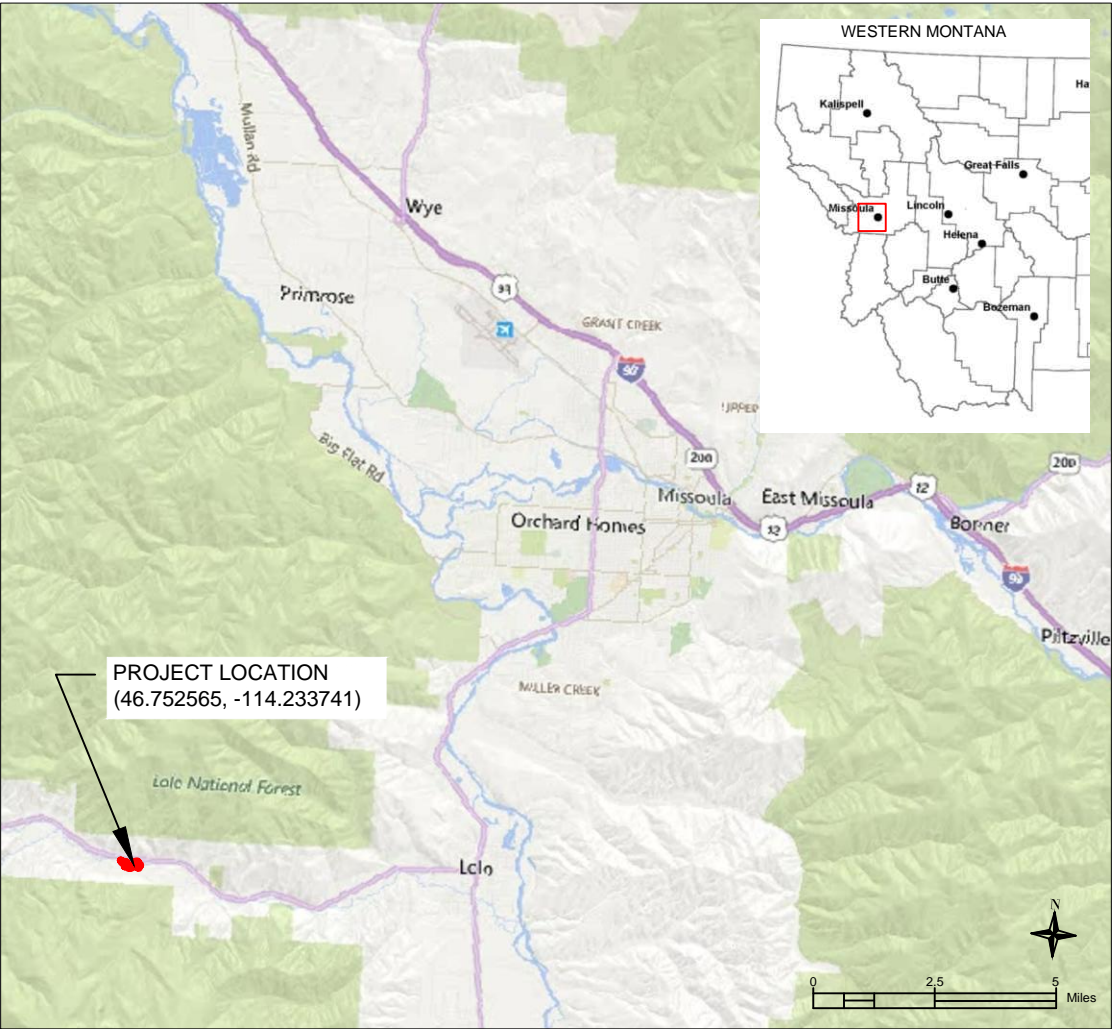
- LOSS OF CREEK MEANDERS DUE TO CHANNELIZATION AND CONFINEMENT BY ARMORING
- LACK OF WOODY DEBRIS AND DIMINISHED WETLANDS
- DEWATERING AND FISH BARRIERS

AS A RESULT, THE LOLO WATERSHED GROUP TEAMED WITH GEUM ENVIRONMENTAL CONSULTING (GEUM) TO IDENTIFY POTENTIAL RESTORATION PROJECTS WITHIN THE WATERSHED THAT WOULD MEET WRP GOALS. THE SECTION OF LOLO CREEK RUNNING THROUGH THE ZENS PROPERTY WAS SELECTED AS HAVING HIGH POTENTIAL TO MEET BOTH LWG AND DEQ GOALS FOR LOLO CREEK. THIS PROJECT INCLUDES A SERIES OF RESTORATION ACTIONS DESIGNED TO MAXIMIZE CHANNEL AND FLOODPLAIN FUNCTION BY INCREASING CHANNEL AND FLOODPLAIN DIVERSITY AND CONNECTIVITY.

SHEET INDEX:

- 1.0 COVER SHEET
- 2.0 EXISTING CONDITIONS
- 3.0 RESTORATION PLAN OVERVIEW
- 3.1 EXISTING VS. PROPOSED CONDITION
- 4.0 PLANVIEW STRUCTURE LAYOUT AND PROFILE
- 4.1 PLANVIEW STRUCTURE LAYOUT AND PROFILE
- 5.0 CHANNEL CROSS SECTION DIMENSIONS
- 6.0 REVEGETATION PLAN
- 7.1 LARGE WOOD STRUCTURE DETAIL
- 7.2 VEGETATED WOOD MATRIX DETAIL
- 7.3 CONSTRUCTED CHANNEL BED DETAIL
- 7.4 BEAVER DAM ANALOG AND SIDE CHANNEL DETAIL
- 7.5 FLOODPLAIN TREATMENT DETAIL
- 8.0 BMP DETAILS
- 9.0 MATERIALS AND QUANTITIES

VICINITY MAP:



PRELIMINARY -
NOT FOR
CONSTRUCTION

COVER SHEET

LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA

DRAWN BY: GEUM AND RDG
DESIGNED BY: GEUM AND RDG
DATE: NOVEMBER 2020

SHEET
1.0



EXISTING CONDITIONS

LOLO CREEK FLOWS INTO THE BITTERROOT RIVER NEAR LOLO, MONTANA. THE ZENS PROPERTY INCLUDES APPROXIMATELY 3,000 LINEAR FEET OF LOLO CREEK. ELEVATION RANGES FROM 3,465 FEET AT THE UPSTREAM END OF THE PROPERTY TO 3,447 FEET AT THE DOWNSTREAM END OF THE PROPERTY. THE BASIN AREA UPSTREAM OF THE ZENS PROPERTY IS 224.5 SQUARE MILES. THE WATERSHED HAS BEEN SUBJECT TO NUMEROUS DEVELOPMENTS, INCLUDING RESIDENTIAL DEVELOPMENT, ROAD AND BRIDGE CONSTRUCTION, CONVERSION OF FLOODPLAIN FOR AGRICULTURAL USE, TIMBER HARVEST, BEAVER REMOVAL, AND WATER DIVERSIONS, THAT HAVE IMPAIRED LOLO CREEK. SEVERAL MEANDERS OF LOLO CREEK WERE CUT OFF FOR CONSTRUCTION OF HIGHWAY 12.

THE UPPER 250 FEET OF LOLO CREEK ON THE ZENS PROPERTY FLOW ALONG HIGHWAY 12 AND ARE STABILIZED BY RIPRAP. DOWNSTREAM OF THE ACCESS BRIDGE TO THE PROPERTY, THE CHANNEL IS STRAIGHTENED AND OVER-WIDENED CONSISTING OF A LONG, SHALLOW RIFFLE WITH LITTLE INSTREAM COVER. THE PROPERTY INCLUDES EXTENSIVE HISTORIC FLOODPLAIN AREA, SOME OF WHICH HAS BEEN DISCONNECTED THROUGH RIPRAP AND LEVEE CONSTRUCTION. RIPARIAN VEGETATION CONSISTS OF POCKETS OF DIVERSE RIPARIAN VEGETATION, SUCH AS WILLOWS AND COTTONWOODS, IN DEPOSITIONAL AREAS ALONG THE EXISTING CHANNEL, WITH MATURE COTTONWOOD AND CONIFERS AND WEEDY HERBACEOUS VEGETATION IN HIGHER ELEVATION AREAS. THE DOWNSTREAM MOST MEANDER ON THE PROPERTY IS ACTIVELY ERODING INTO A LOW TERRACE.

THE PRIMARY IMPAIRMENTS TO LOLO CREEK ON THE ZENS PROPERTY INCLUDE:

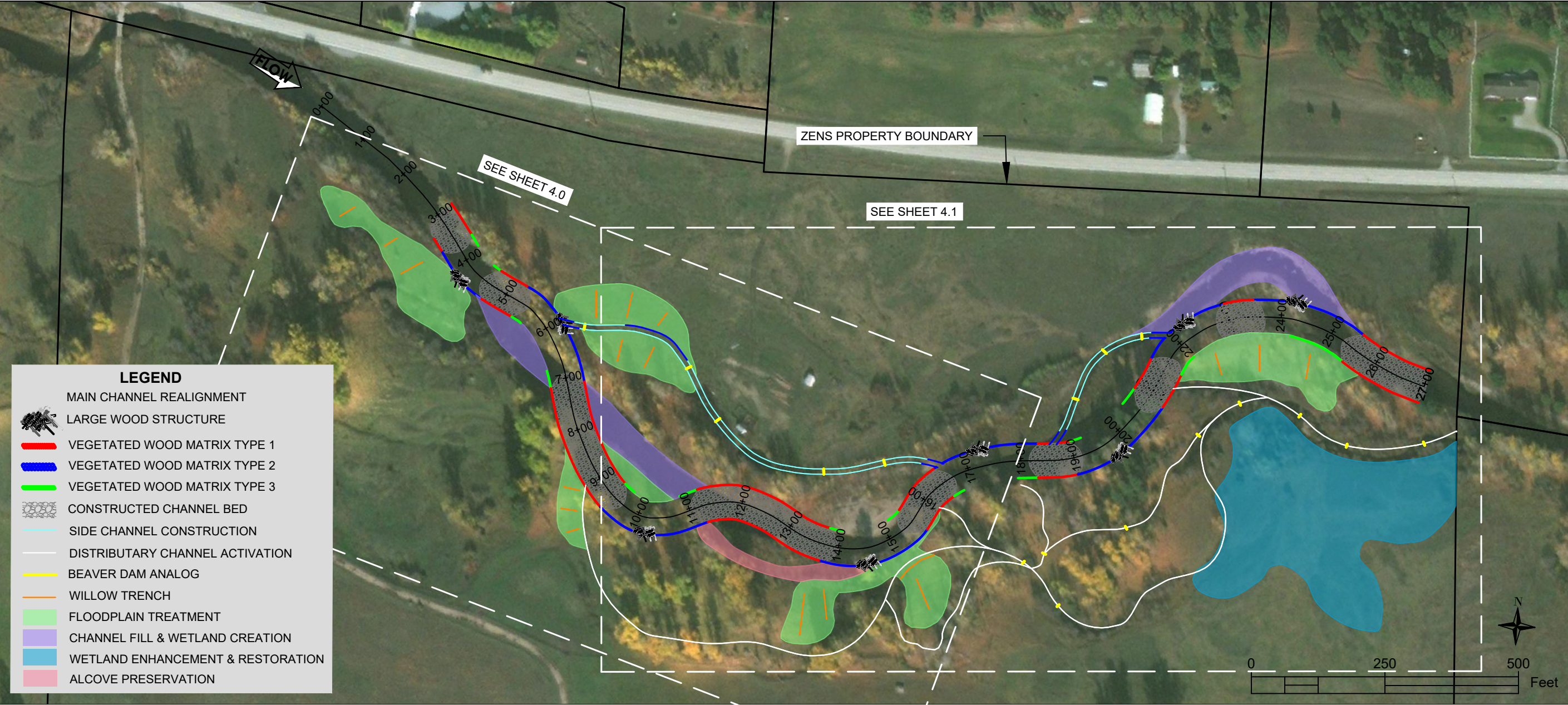
- CHANNEL CONFINEMENT WITH RIPRAP AND CHANNEL STRAIGHTENING
- REDUCED FLOODPLAIN CONNECTIVITY
- CHANNEL OVER-WIDENING
- LOSS OF AQUATIC HABITAT DIVERSITY (POOLS AND WOODY DEBRIS)
- REDUCED RIPARIAN VEGETATION COVER
- ACCELERATED STREAMBANK EROSION

LOLO CREEK ZENS PROPERTY STREAM CHARACTERISTICS	
DRAINAGE AREA	224.5 SQUARE MILES
MEAN/ANNUAL PRECIPITATION	39.0 INCHES
FOREST COVER	82.9%
BASEFLOW DISCHARGE	50-150 CFS
EST. BANKFULL DISCHARGE (Q1.5)	700-800 CFS
VALLEY GRADIENT	.024 FT/FT
CHANNEL GRADIENT	.006 FT/FT
EXISTING STREAM TYPE	C4
MAXIMUM ELEVATION	3464.5
MINIMUM ELEVATION	3447.0

EXISTING CONDITIONS

LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA

DRAWN BY: GEUM AND RDG
DESIGNED BY: GEUM AND RDG
DATE: NOVEMBER 2020



RESTORATION OBJECTIVES

IN 2013, THE LOLO WATERSHED GROUP (LWG) AND PARTNERS COMPLETED THE *LOLO WATERSHED RESTORATION PLAN* (WRP) WHICH IDENTIFIES A 5-10 YEAR PLAN TO ACHIEVE CONSERVATION AND RESTORATION GOALS IN THE LOLO CREEK WATERSHED. THE WRP DESCRIBES THE FOLLOWING ISSUES FOR FISHERIES, WILDLIFE AND WATER QUALITY/QUANTITY IN THE WATERSHED: LOSS OF CREEK MEANDERS DUE TO CHANNELIZATION AND CONFINEMENT BY ARMORING; LACK OF WOODY DEBRIS AND DIMINISHED WETLANDS; AND DEWATERING AND FISH BARRIERS. THE LOLO WATERSHED RESTORATION PLAN INDICATES THAT ACTIVITIES IN LOLO CREEK SHOULD INCLUDE EFFORTS TO REACH THE DIVERSE OWNERSHIP AND OTHER STAKEHOLDERS THROUGH EDUCATION, OUTREACH AND STEWARDSHIP ACTIVITIES TO HELP REALIZE THE WATERSHED GROUP'S VISION OF DROUGHT MANAGEMENT, SURFACE AND GROUND WATER QUANTITY IMPROVEMENT, WEED REDUCTION, HEALTHY AND WELL ESTABLISHED STREAMSIDE VEGETATION, PROPER STREAM STRUCTURE AND FUNCTION, AND REDUCTION IN FISH ENTRAINMENT IN IRRIGATION DITCHES. THE ZENS PROJECT HELPS THE LOLO WATERSHED GROUP MEET SEVERAL ASPECTS OF ITS VISION FOR THE WATERSHED.

- THE GOAL FOR RESTORATION AT THE ZENS PROPERTY IS TO MAXIMIZE CHANNEL AND FLOODPLAIN FUNCTION BY INCREASING CHANNEL AND FLOODPLAIN DIVERSITY AND CONNECTIVITY BETWEEN THE CHANNEL AND THE FLOODPLAIN. A SECONDARY, AND EQUALLY IMPORTANT GOAL OF THE PROJECT IS TO CREATE A DEMONSTRATION OF HOW AQUATIC HABITAT ENHANCEMENT AND FLOODPLAIN RECONNECTION CAN IMPROVE OVERALL WATERSHED FUNCTION AND SUPPORT LAND USES.

RESTORATION TREATMENTS

TO ACHIEVE RESTORATION OBJECTIVES, RESTORATION WORK INCLUDES THE FOLLOWING:

- **CONSTRUCT CHANNEL MEANDERS** TO INCREASE CHANNEL DIVERSITY AND ACTIVE FLOODPLAIN AREA.
- **CHANNEL SHAPING** TO NARROW AND DEEPEN THE CHANNEL AND INCREASE AQUATIC HABITAT DIVERSITY.
- **ADD LARGE WOODY DEBRIS TO THE CHANNEL AND FLOODPLAIN** TO INCREASE AQUATIC HABITAT DIVERSITY AND COVER AND INCREASE FLOODPLAIN ROUGHNESS AND HABITATS.
- **CONSTRUCT SIDE CHANNELS AND ACTIVATE ABANDONED FLOODPLAIN CHANNELS** TO INCREASE FLOODPLAIN DIVERSITY AND WETLANDS.
- **REMOVE BERM ALONG STREAM** TO REACTIVE ABANDONED FLOODPLAIN AREAS.
- **REALIGN THE CHANNEL AWAY FROM THE ERODING STREAMBANK AT THE DOWNSTREAM END OF THE PROPERTY** WHERE ACTIVE STREAMBANK EROSION AND CHANNEL INCISION IS OCCURRING.
- **INCREASE FLOODPLAIN WETLAND AREA** THROUGH FLOODPLAIN ACTIVATION, GRADING AND REVEGETATION.
- **INSTALL BEAVER DAM ANALOG STRUCTURES** IN SIDE CHANNELS AND ACTIVATED FLOODPLAIN CHANNELS TO MIMIC THE FUNCTION OF BEAVER DAMS AND ENCOURAGE EXPANSION OF USE OF HABITAT BY BEAVER.
- **PRESERVE EXISTING HIGH-QUALITY FLOODPLAIN AND RIPARIAN AREAS** SUCH AS ACTIVE SIDE CHANNELS, HISTORIC FLOODPLAIN CHANNELS THAT HAVE BEEN DISCONNECTED BUT SUPPORT WETLAND VEGETATION, HISTORIC MEANDER SCROLLS, ALCOVE FEATURES, AND DEPOSITIONAL FEATURES ALONG THE CHANNEL.
- **REVEGETATION** OF STREAMBANKS AND FLOODPLAINS THROUGH NATIVE SPECIES SEEDING AND PLANTING; INSTALLATION OF DORMANT WILLOW CUTTINGS IN THE FLOODPLAIN AND STREAMBANKS; AND TRANSPLANT OF RIPARIAN SHRUBS AND WETLAND SOD.
- **WETLAND ENHANCEMENT AND RESTORATION** TO INCREASE WETLAND AREA AND INCREASE THE ECOLOGICAL FUNCTION OF EXISTING WETLANDS. POTENTIAL WETLAND ENHANCEMENT AND RESTORATION WOULD INCLUDE SEVERAL TREATMENTS INCLUDING TOPOGRAPHIC VARIATION, SURFACE ROUGHNESS, PLANTING AND SEEDING.



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PROJECTION: MT SP
UNITS: US FOOT
DATA SOURCES: 2020 BING IMAGERY

RESTORATION PLAN OVERVIEW

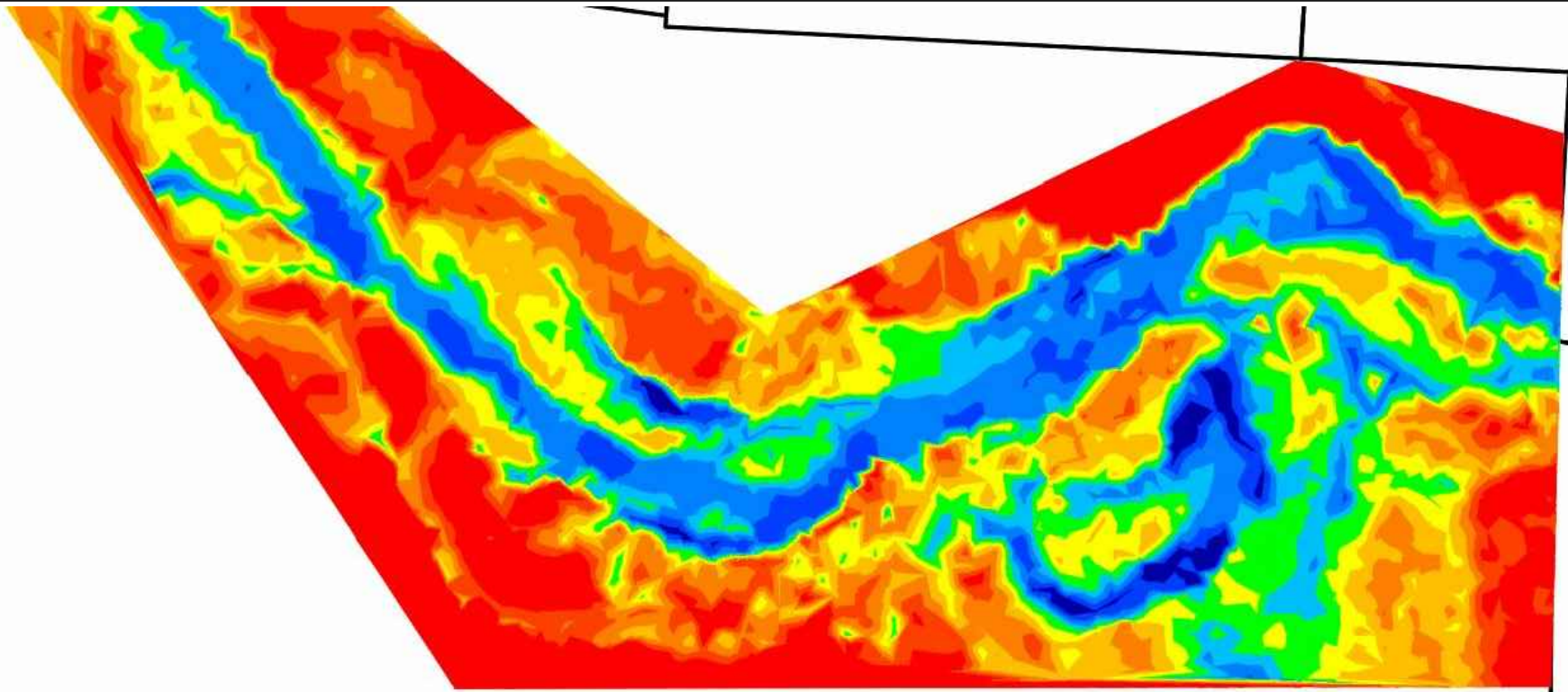
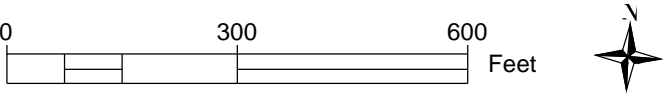
LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA

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DESIGNED BY: GEUM AND RDG
DATE: NOVEMBER 2020

SHEET
3.0

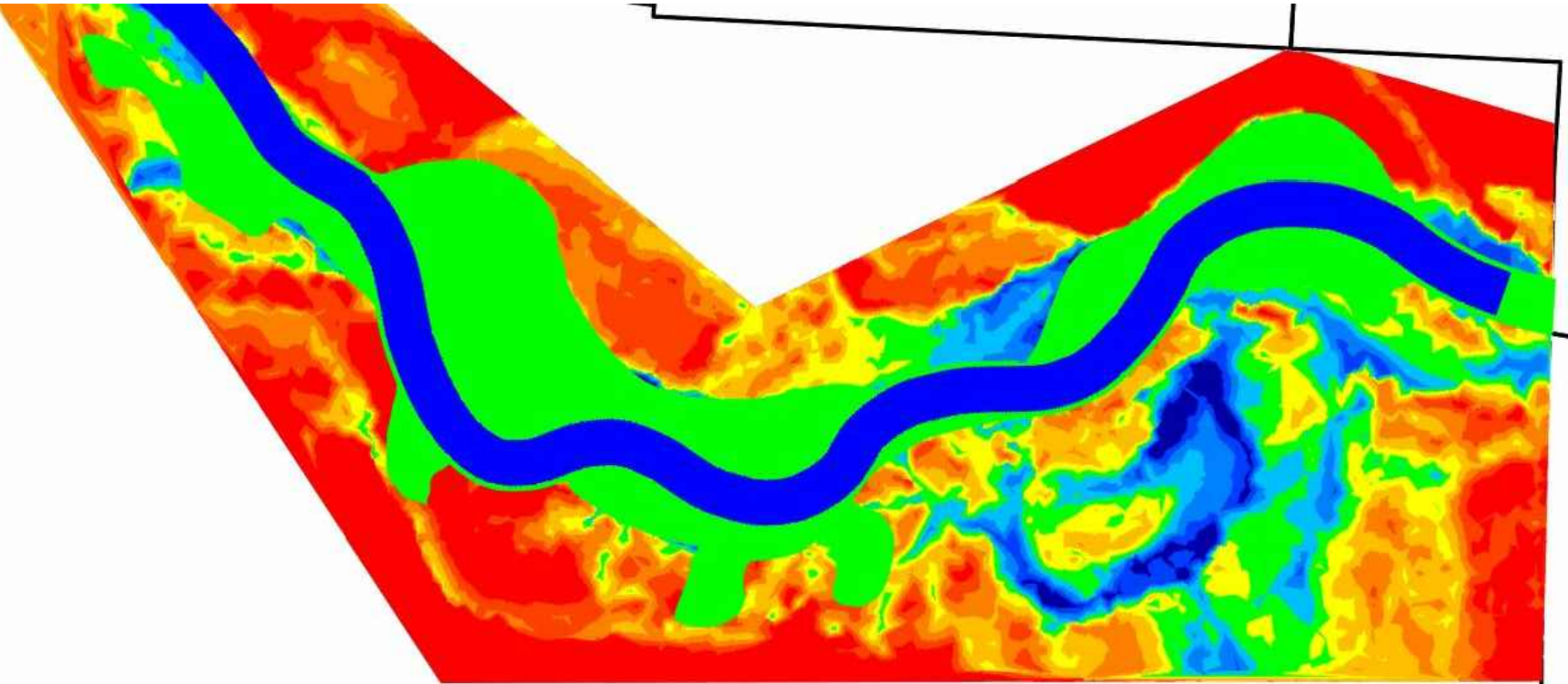
EXISTING CONDITION

ELEVATION RELATIVE TO ESTIMATED BANKFULL				
	Minimum Elevation	Maximum Elevation	Color	Area
	-3.0	-2.0	<div></div>	0.67
	-2.0	-1.5	<div></div>	2.19
	-1.5	-1.0	<div></div>	3.98
	-1.0	-0.5	<div></div>	2.70
	-0.5	0.0	<div></div>	3.41
	0.0	0.5	<div></div>	4.03
	0.5	1.0	<div></div>	4.42
	1.0	1.5	<div></div>	4.15
	1.5	2.0	<div></div>	3.69
	2.0	25.0	<div></div>	6.63



PROPOSED CONDITION

ELEVATION RELATIVE TO ESTIMATED BANKFULL				
	Minimum Elevation	Maximum Elevation	Color	Area
	-5.0	-2.0	<div></div>	3.46
	-2.0	-1.5	<div></div>	1.17
	-1.5	-1.0	<div></div>	1.18
	-1.0	-0.5	<div></div>	1.76
	-0.5	0.0	<div></div>	9.47
	0.0	0.5	<div></div>	2.65
	0.5	1.0	<div></div>	3.19
	1.0	1.5	<div></div>	3.54
	1.5	2.0	<div></div>	3.26
	2.0	25.0	<div></div>	6.17



COMPARISON OF EXISTING VS ESTIMATED POST RESTORATION CONDITION

METRIC	PRE	POST
CHANNEL SINUOSITY	1.24	1.26
LENGTH OF CONNECTED FLOODPLAIN CHANNELS AND SIDE CHANNELS (FT)	950	4700
WETLAND AREA (ACRES)	8.3	9.2
CONNECTED FLOODPLAIN (ACRES)	3.41	9.47

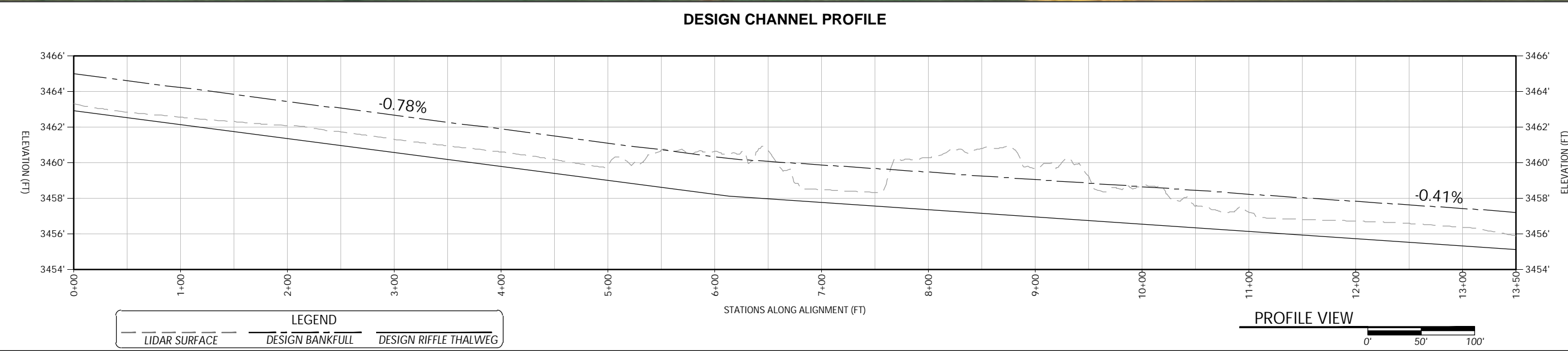
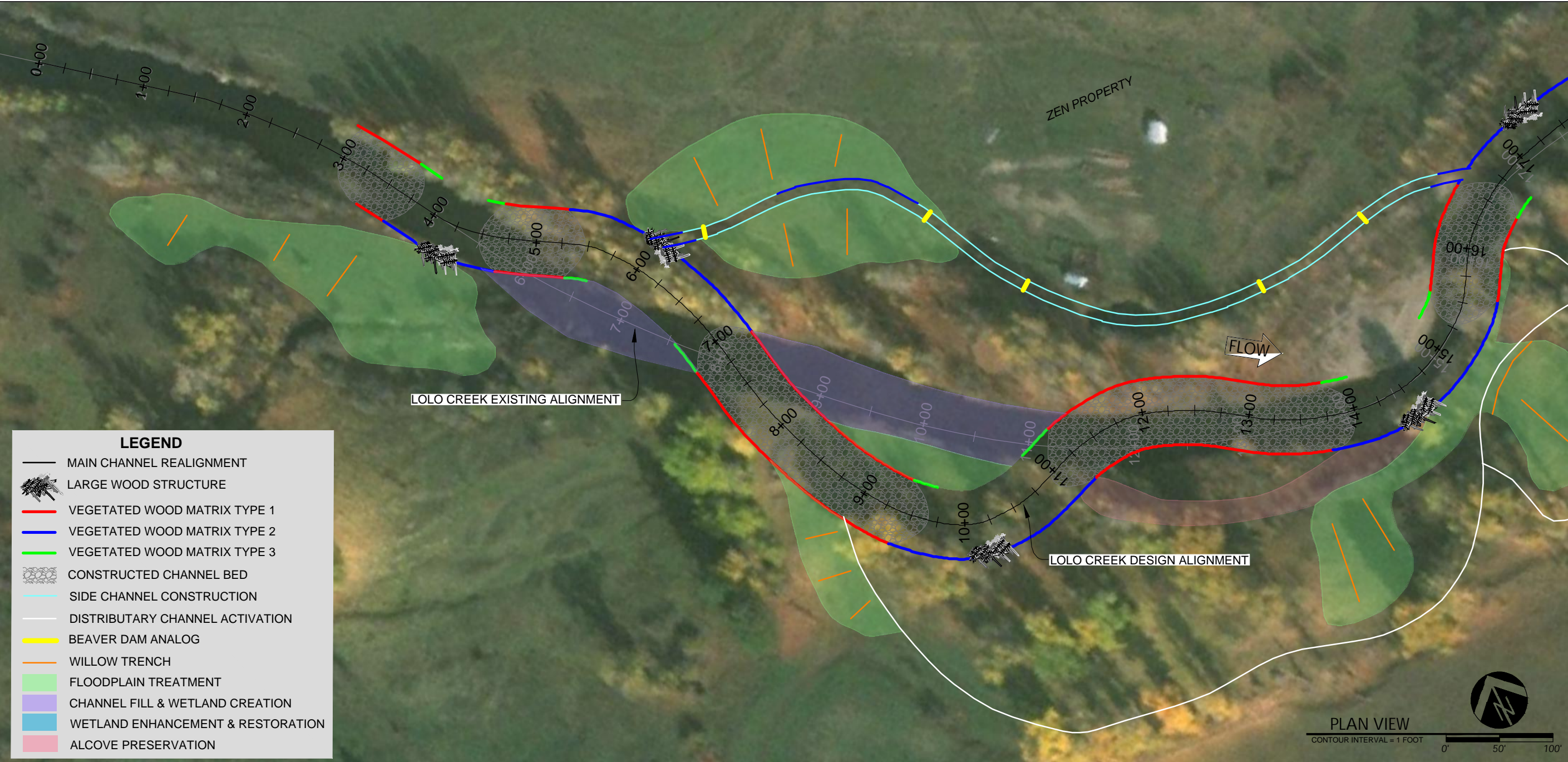


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EXISTING VS PROPOSED CONDITION

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LOLO, MONTANA

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PLAN VIEW STRUCTURE LAYOUT AND PROFILE

LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA

LEGEND

MAIN CHANNEL REALIGNMENT

LARGE WOOD STRUCTURE

VEGETATED WOOD MATRIX TYPE 1

VEGETATED WOOD MATRIX TYPE 2

VEGETATED WOOD MATRIX TYPE 3

CONSTRUCTED CHANNEL BED

SIDE CHANNEL CONSTRUCTION

DISTRIBUTARY CHANNEL ACTIVATION

BEAVER DAM ANALOG

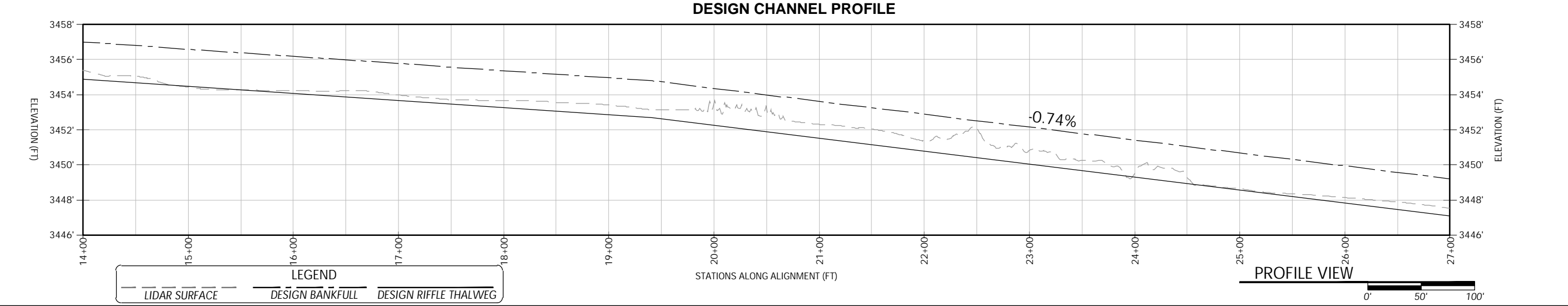
WILLOW TRENCH

FLOODPLAIN TREATMENT

CHANNEL FILL & WETLAND CREATION

WETLAND ENHANCEMENT & RESTORATION

ALCOVE PRESERVATION



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PLAN VIEW STRUCTURE LAYOUT AND PROFILE

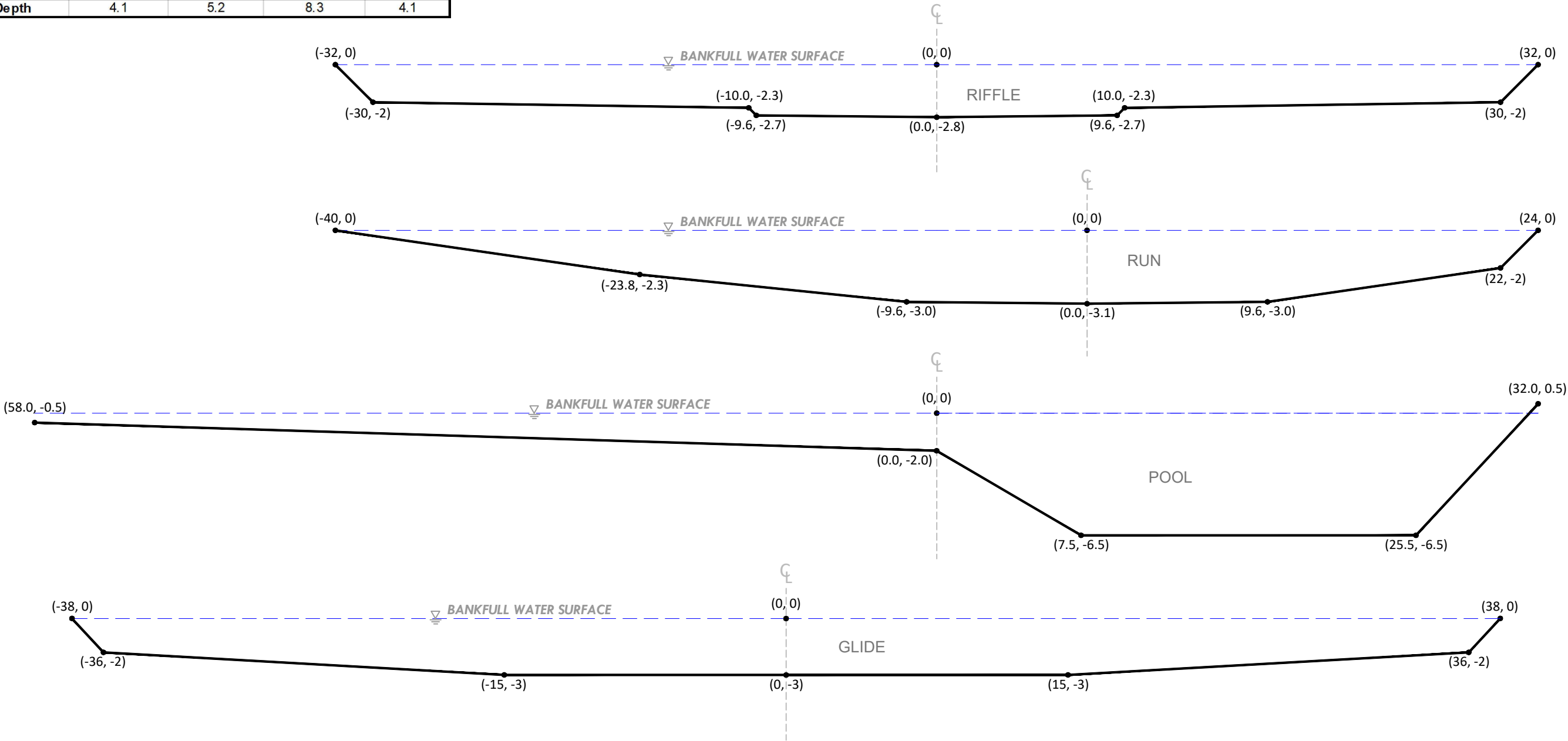
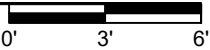
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LOLO, MONTANA

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DATE: NOVEMBER 2020

SHEET
4.1

BANKFULL CROSS SECTION DESIGN CRITERIA				
	Riffle	Run	Pool	Glide
	Value (ft)	Value (ft)	Value (ft)	Value (ft)
Area	130	137	163	150
Range (Low)	125	104	143	117
Range (High)	135	156	182	182
Width/Depth Ratio	32	25	-	41
Range (Low)	30	17	-	32
Range (High)	34	35	-	53
Width				
Average	64	67	80	77
Range (Low)	60	51	70	70
Range (High)	66	83	90	83
Avg. Depth				
Average	2.1	2.7	2.0	1.9
Range (Low)	2.0	2.4	1.8	1.6
Range (High)	2.2	3.0	2.3	2.2
Max. Depth				
Average	2.9	4.1	6.5	2.9
Range (Low)	2.7	3.3	5.8	2.5
Range (High)	3.1	4.8	7.2	3.3
Scour Depth	4.1	5.2	8.3	4.1

CHANNEL CROSS SECTIONS
TYPICAL



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CHANNEL CROSS SECTION
DIMENSIONS

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EXISTING VEGETATION PRESERVATION: AREAS ALONG THE MAIN CHANNEL THAT SUPPORT NATIVE WOODY RIPARIAN VEGETATION WILL BE INTEGRATED INTO PROJECT GRADING AND PRESERVED.

SHRUB AND WETLAND SOD SALVAGE AND TRANSPLANT: DESIRABLE WOODY SPECIES, SUCH AS DOGWOOD, ALDER, WILLOW, AND COTTONWOOD WITHIN CONSTRUCTION LIMITS WILL BE SALVAGED AND RE-USED IN STREAMBANKS OR ON CONSTRUCTED FLOODPLAIN SURFACES.

DORMANT VEGETATIVE CUTTINGS: ALL STREAMBANK TREATMENTS WILL INTEGRATE DORMANT WILLOW CUTTINGS OF WILLOW, COTTONWOOD AND DOGWOOD TO ESTABLISH DESIRABLE WOODY RIPARIAN VEGETATION ALONG THE CHANNEL. DORMANT VEGETATIVE CUTTINGS WILL ALSO BE PLACED IN TRENCHES IN CONSTRUCTED IN FLOODPLAIN TREATMENT AREAS TO INCREASE THE COVER AND AREA OF DESIRED WOODY RIPARIAN VEGETATION.

CONTAINERIZED PLANTING: CONTAINERIZED WOODY SPECIES, SUCH AS COTTONWOOD, ALDER, WILLOW, AND DOGWOOD WILL BE PLANTED INTO CONSTRUCTED FLOODPLAIN SURFACES TO INCREASE THE AREA AND COVER OF DESIRABLE WOODY RIPARIAN SPECIES. INDIVIDUAL PLANT PROTECTORS WOULD BE INSTALLED TO PROTECT CONTAINERIZED PLANTS FROM BROWSE BY WILDLIFE.

SEEDING: ALL NEWLY CONSTRUCTED FLOODPLAIN SURFACES AND DISTURBED AREAS WILL BE SEEDED USING A MIX OF NATIVE GRASSES AND FORBS. IN ADDITION TO BROADCAST SEEDING OF COMMERCIAL SEED MIXES, COLLECTION AND DIRECT SEEDING OF ALDER CONES ON LOW FLOODPLAIN SURFACES WOULD ALSO OCCUR. ALDER CONES CAN BE COLLECTED DURING DORMANCY (OCTOBER THROUGH MARCH). THE CONES CAN BE STORED OVER WINTER AND AS THE CONES DRY THEY WILL OPEN AND RELEASE TINY SEEDS. THIS SEED CAN BE ADDED TO COMMERCIAL SEED MIXES OR SEEDED SEPARATELY. ALTERNATELY, ALDER CONES CAN ALSO BE COLLECTED IN THE FALL FOLLOWING CONSTRUCTION AND SPREAD ONTO THE NEWLY CONSTRUCTED FLOODPLAIN SURFACE.

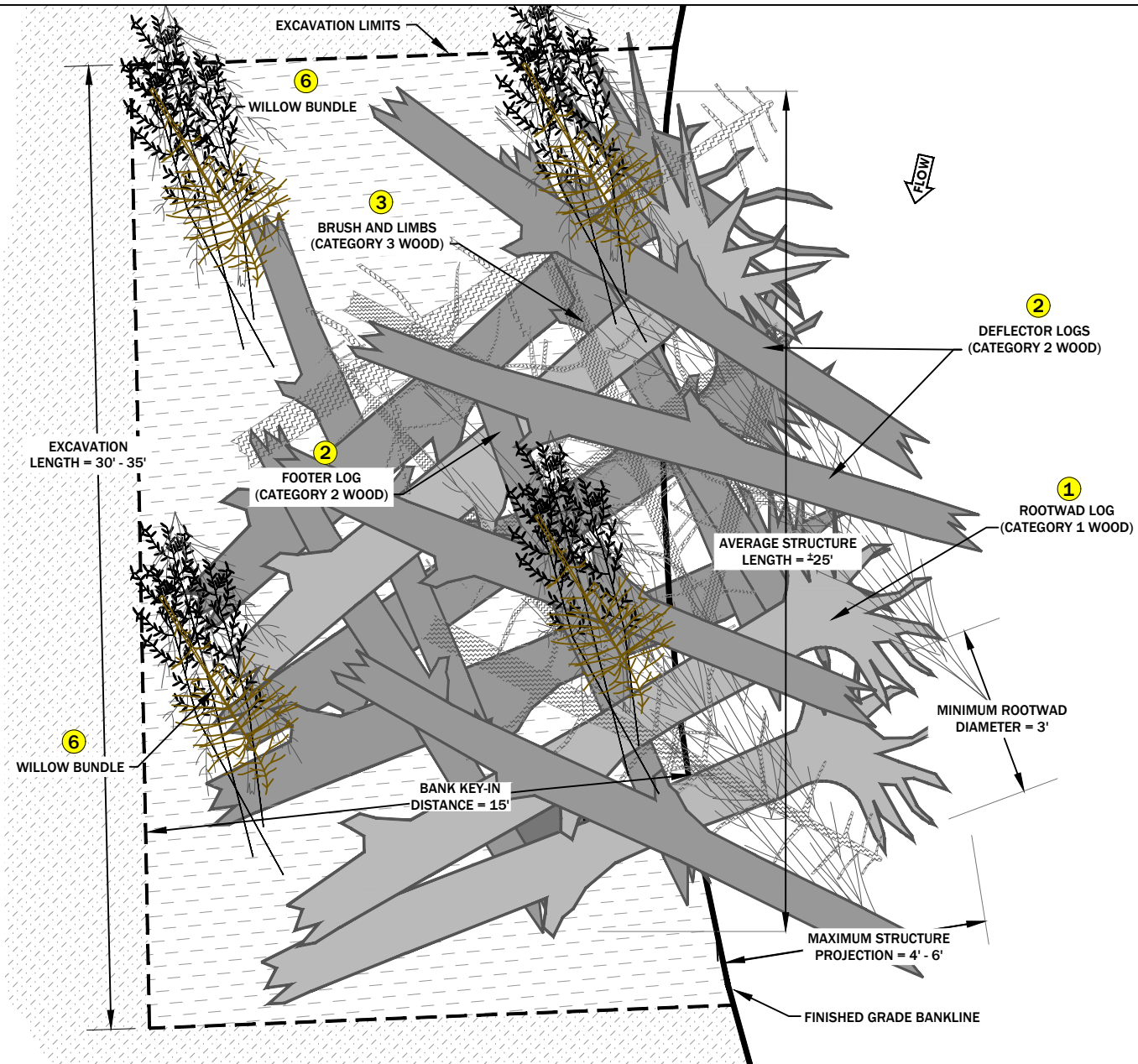


EXAMPLE OF STREAMBANK TREATMENT WITH WILLOW CUTTINGS

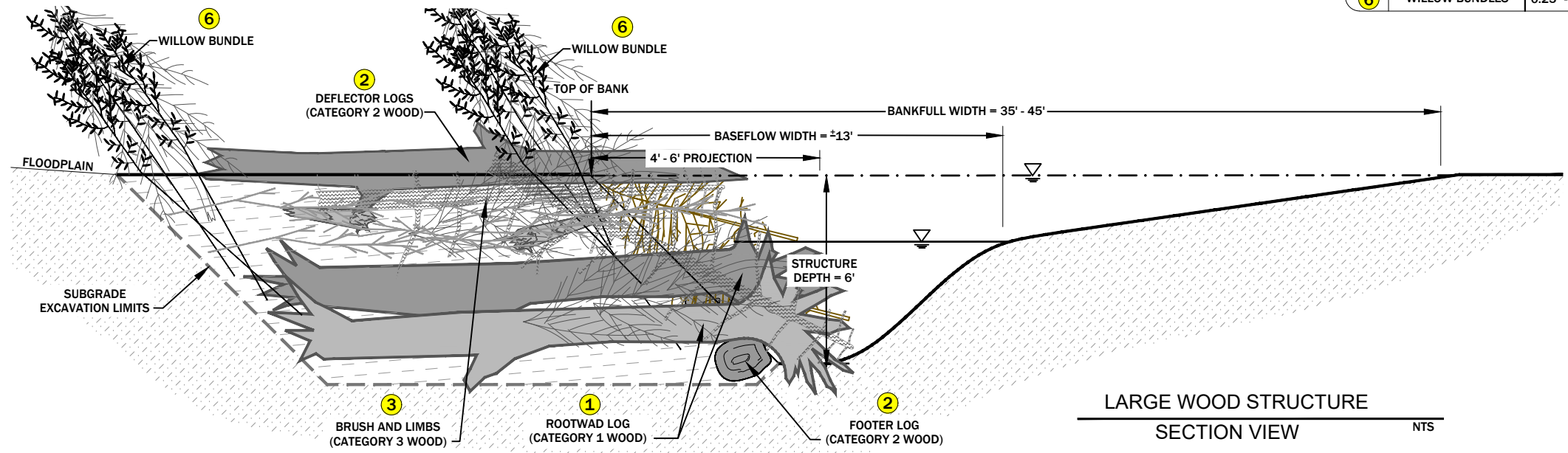
REVEGETATION PLAN

LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA

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DATE: NOVEMBER 2020



LARGE WOOD STRUCTURE
PLAN VIEW



LARGE WOOD STRUCTURE
SECTION VIEW

GENERAL NOTES

1. CONSTRUCTION OF THE LARGE WOOD STRUCTURE WILL OCCUR BEFORE THE CONSTRUCTED CHANNEL STREAMBED AND VEGETATED WOOD MATRIX BANK TREATMENTS ARE INSTALLED. INSTALLATION OF FLOODPLAIN TREATMENT SHALL BE COMPLETED AFTER THE LARGE WOOD STRUCTURES ARE INSTALLED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY THE CONSTRUCTION MANAGER.
3. CONSTRUCTION MANAGER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH LARGE WOOD STRUCTURE PRIOR TO CONSTRUCTION.

NOTES ON LARGE WOOD STRUCTURE INSTALLATION

1. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. INSTALL TWO FOOTER LOGS (CATEGORY 2 WOOD) AT THE BASE OF THE EXCAVATED TRENCH AT THE ORIENTATIONS NOTED IN PLAN VIEW. FOOTER LOGS SHALL PROJECT INTO THE DESIGN CHANNEL NO GREATER THEN 3 FEET OR AT DISTANCE DIRECTED BY THE CONSTRUCTION MANAGER. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
3. INSTALL FOUR TO FIVE ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING BOTH FOOTER LOGS AT THE ORIENTATION NOTED IN PLAN VIEW. THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 4 - 6 FT. BEYOND THE FINISHED BANK LINE.
4. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE ROOTWAD LOGS. BACKFILL SHALL BE BUCKET COMPACTED.
5. INSTALL BRUSH AND LIMBS (CATEGORY 3 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 4 - 6 FT. BEYOND THE FINISHED BANK LINE.
6. INSTALL FOUR TO FIVE ROOTWAD LOGS (CATEGORY 1 WOOD) ON TOP OF THE BRUSH AND LIMBS AT THE ORIENTATION NOTED IN PLAN VIEW. THE TOP OF THE ROOTWAD STEMS SHALL SIT AT OR BELOW BASEFLOW ELEVATION (BANKFULL MINUS 2.4). THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 4 - 6 FT. BEYOND THE FINISHED BANK LINE.
7. INSTALL BRUSH AND LIMBS (CATEGORY 3 WOOD) UP TO TOP OF BANK AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 4 - 6 FT. BEYOND THE FINISHED BANK LINE.
8. PLACE FOUR WILLOW BUNDLES (CLUSTER OF 50 WILLOW CUTTINGS IN EACH BUNDLE) INTERWOVEN INTO WOOD MATRIX AS SHOWN IN THE PLAN VIEW. WILLOW BUNDLES SHALL BE SET AS TO BE IN CONTACT WITH LOW FLOW WATER SURFACE ELEVATION.
9. BACKFILL STRUCTURE WITH STOCKPILED MATERIAL UP TO THE TOP OF BANK LINE ELEVATION. BACKFILL SHALL BE BUCKET COMPACTED.
10. INSTALL THREE TO FOUR DEFLECTOR LOGS (CATEGORY 2 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. TOP OF DEFLECTOR LOGS CAN BE UP TO 0.5 FT ABOVE TOP OF BANK ELEVATION AND SHALL PROJECT NO GREATER THAN 6 FT. BEYOND THE FINISHED BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
11. PLACE AND BUCKET COMPACT STOCKPILED MATERIAL TO THE FINISHED BANK LINE. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.

MATERIAL SCHEDULE (PER STRUCTURE)

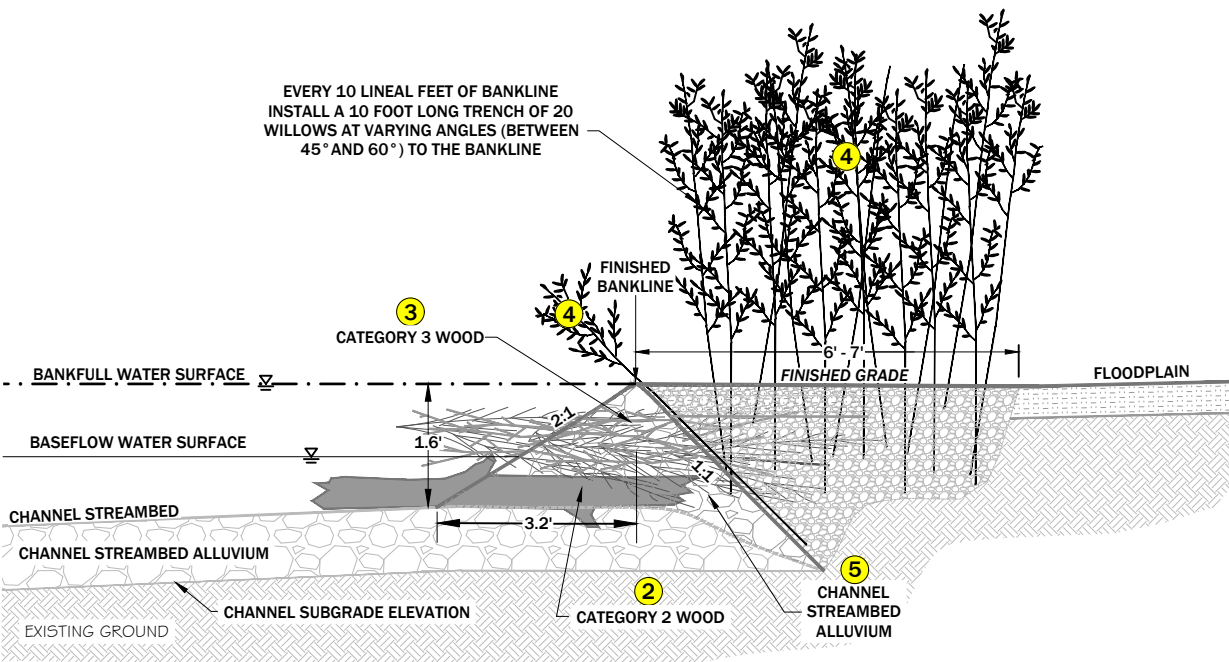
	ITEM	DIA.	QUANTITY
①	CATEGORY 1 WOOD	12" - 18"	6
②	CATEGORY 2 WOOD	6" - 12"	6
③	CATEGORY 3 WOOD	< 3"	15
⑥	WILLOW BUNDLES	0.25" - 1"	4



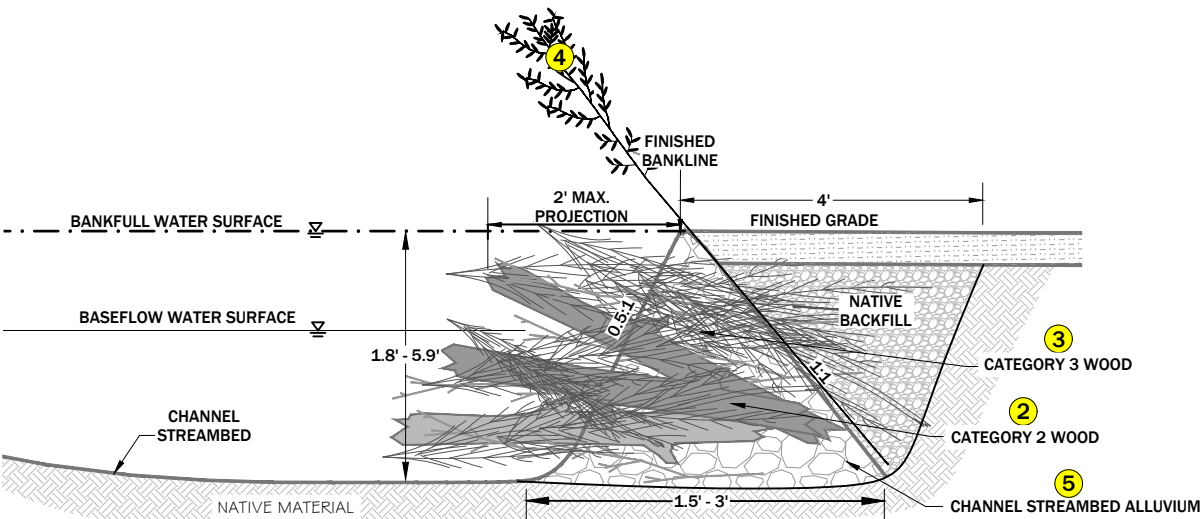
EXAMPLE OF A LARGE WOOD STRUCTURE

LARGE WOOD STRUCTURE DETAIL

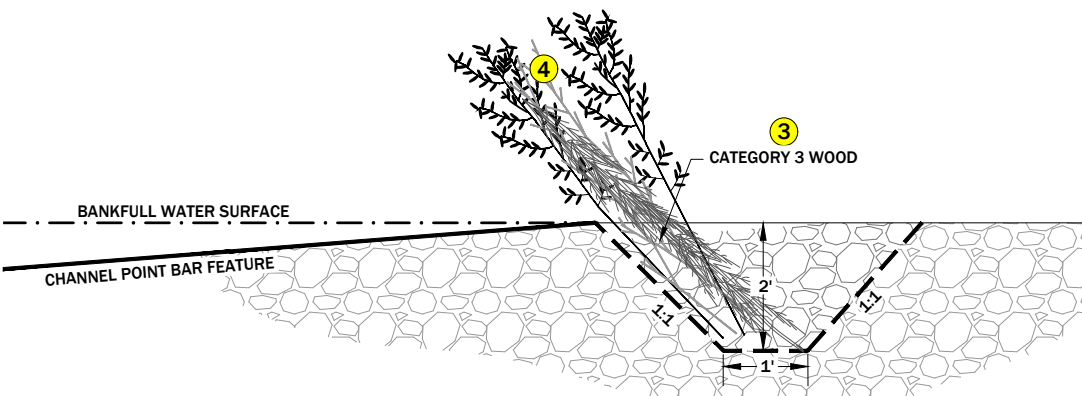
LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA



VEGETATED WOOD MATRIX - TYPE 1
SECTION VIEW
0' 1' 2'



VEGETATED WOOD MATRIX - TYPE 2
SECTION VIEW
0' 1' 2'



VEGETATED WOOD MATRIX - TYPE 3
SECTION VIEW
0' 1.5' 3'

- GENERAL NOTES**
1. CONSTRUCTION OF THE VEGETATED WOOD MATRIX WILL OCCUR AFTER THE CHANNEL AND FLOODPLAIN BACKFILL IS PLACED AND THE CHANNEL STREAMBED IS CONSTRUCTED. INSTALLATION OF FLOODPLAIN TREATMENT SHALL BE COMPLETED AFTER VEGETATED WOOD MATRIXES ARE INSTALLED.
 2. IF VEGETATED WOOD MATRIX STRUCTURES ARE INSTALLED PRIOR TO OCTOBER 1, LEAVE BACK TRENCH UNFILLED AND COMPLETE STRUCTURE WHEN DORMANT WILLOWS ARE AVAILABLE.
 3. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
 4. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY CONSTRUCTION MANAGER.
 5. CONTRACTOR SHALL MARK AND CONSTRUCTION ENGINEER SHALL APPROVE THE GENERAL LOCATION FOR EACH VEGETATED WOOD MATRIX STRUCTURE PRIOR TO CONSTRUCTION.

NOTES ON VEGETATED WOOD MATRIX INSTALLATION

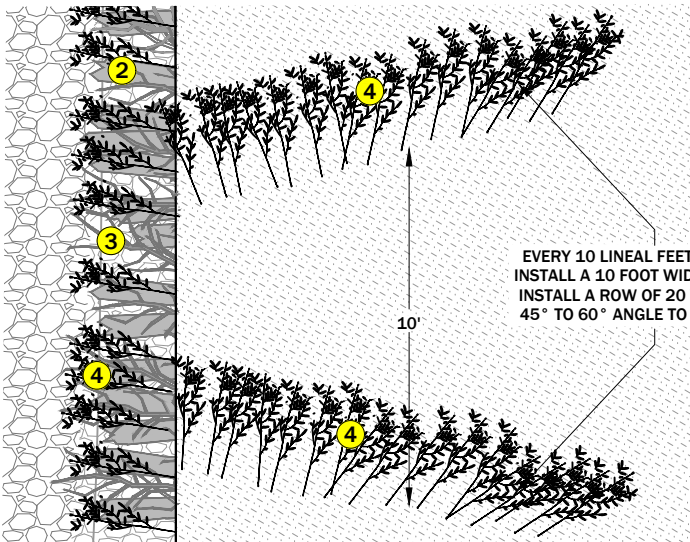
1. EXCAVATE TO THE EXCAVATION LIMITS AS SHOWN. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. PREPARE THE BENCH OF THE STRUCTURE BY PLACING CHANNEL STREAMBED ALLUVIUM FROM THE BASE OF THE EXCAVATION DEPTH/BOTTOM OF EXCAVATION TO WITHIN 1.0-FT. OF FINISHED GRADE.
3. CATEGORY 2 AND CATEGORY 3 WOOD, AND CHANNEL STREAMBED ALLUVIUM SHALL BE PLACED IN ALTERNATING LAYERS AND BUCKET COMPACTED UP TO THE TOP OF BANK ELEVATION AS SHOWN BELOW IN THE INSTALLATION SEQUENCE. PLACE SIX (6) FT TO EIGHT (8) FT. DORMANT WILLOW CUTTINGS AT A DENSITY OF 5 PER LINEAR FT ALONG THE TOP OF BANK LINE ELEVATION. WILLOW CUTTINGS SHALL SLOPE AT AN APPROXIMATE 1:1 SLOPE AS SHOWN IN SECTION VIEW. STEMS MAY OVERLAP. THE CUT ENDS SHALL BE PLACED AT THE BASE OF THE SLOPES WITH THE UN-CUT ENDS EXTENDING BEYOND THE EDGE OF THE TRENCH SO NO GREATER THAN ONE-THIRD OF THE TOTAL CUTTING LENGTH IS EXPOSED BEYOND THE TOP OF BANK EDGE. WILLOW CUTTINGS SHOULD INTERCEPT THE DESIGN TOP OF BANK LINE AS SHOWN IN STEP 5 OF THE INSTALLATION SEQUENCE.
4. THE UPSTREAM AND DOWNSTREAM ENDS OF THE STRUCTURE SHALL TRANSITION SMOOTHLY INTO ADJACENT STREAMBANK STRUCTURES TO MINIMIZE EROSION, FLANKING, AND BANK FAILURE. STRUCTURE ENDS MAY BE STABILIZED WITH ADDITIONAL CATEGORY 1 ROCK AS APPROVED BY ENGINEER.
5. AFTER INSTALLATION OF THE VEGETATED WOOD MATRIX, BACKFILL THE STRUCTURE WITH STOCKPILED MATERIAL TO FINISHED GRADE, AND BUCKET COMPACT. INSTALL WILLOW TRENCHES AT A RATE OF 2 PER LINEAR FOOT (OR 20 PER TRENCH) AS SHOWN. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.

STREAMBANK ALLUVIUM GRADATION

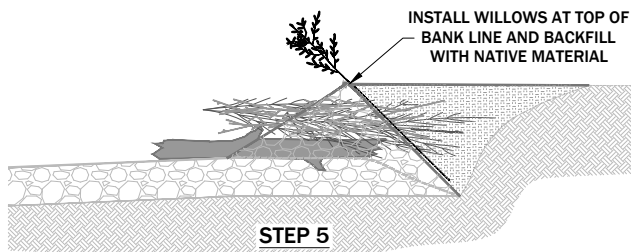
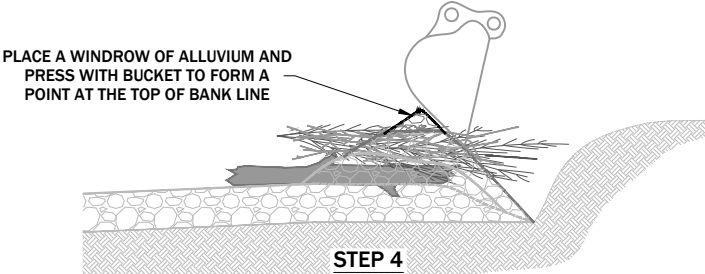
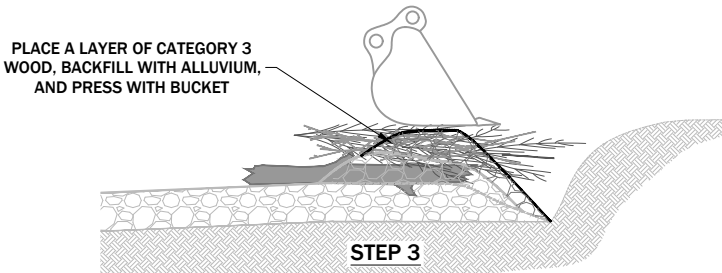
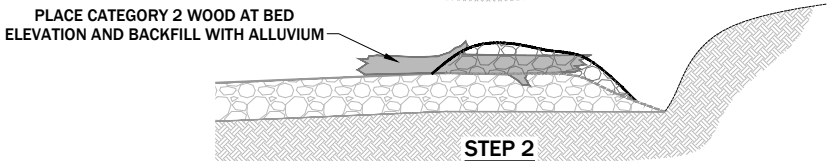
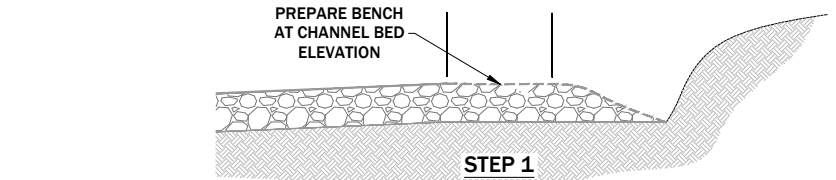
SIZE (INCHES)	PERCENT PASSING
8	95
7	80 - 90
6	65 - 75
4	45 - 60
2	35 - 40
1	25 - 30
0.6	20

MATERIAL SCHEDULE (PER LINEAR FOOT)

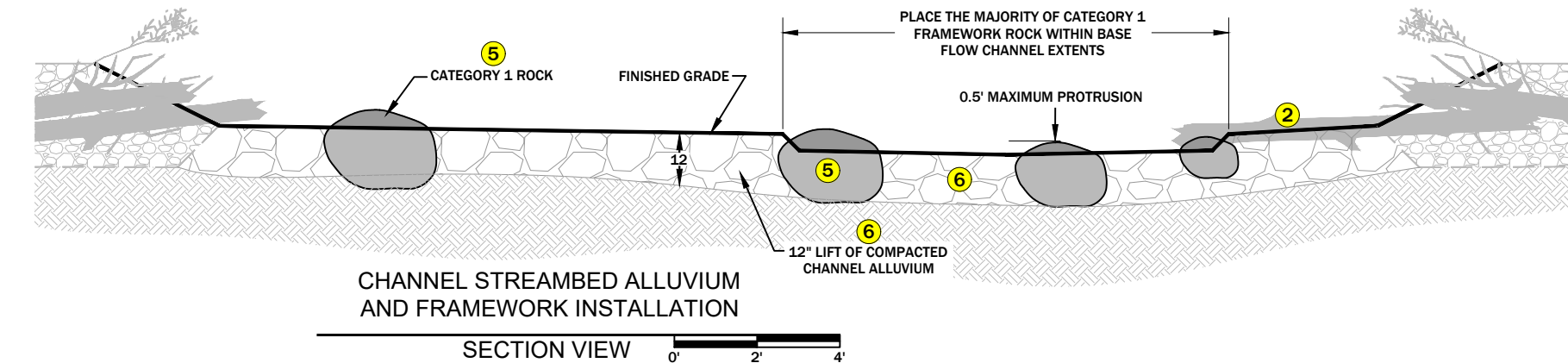
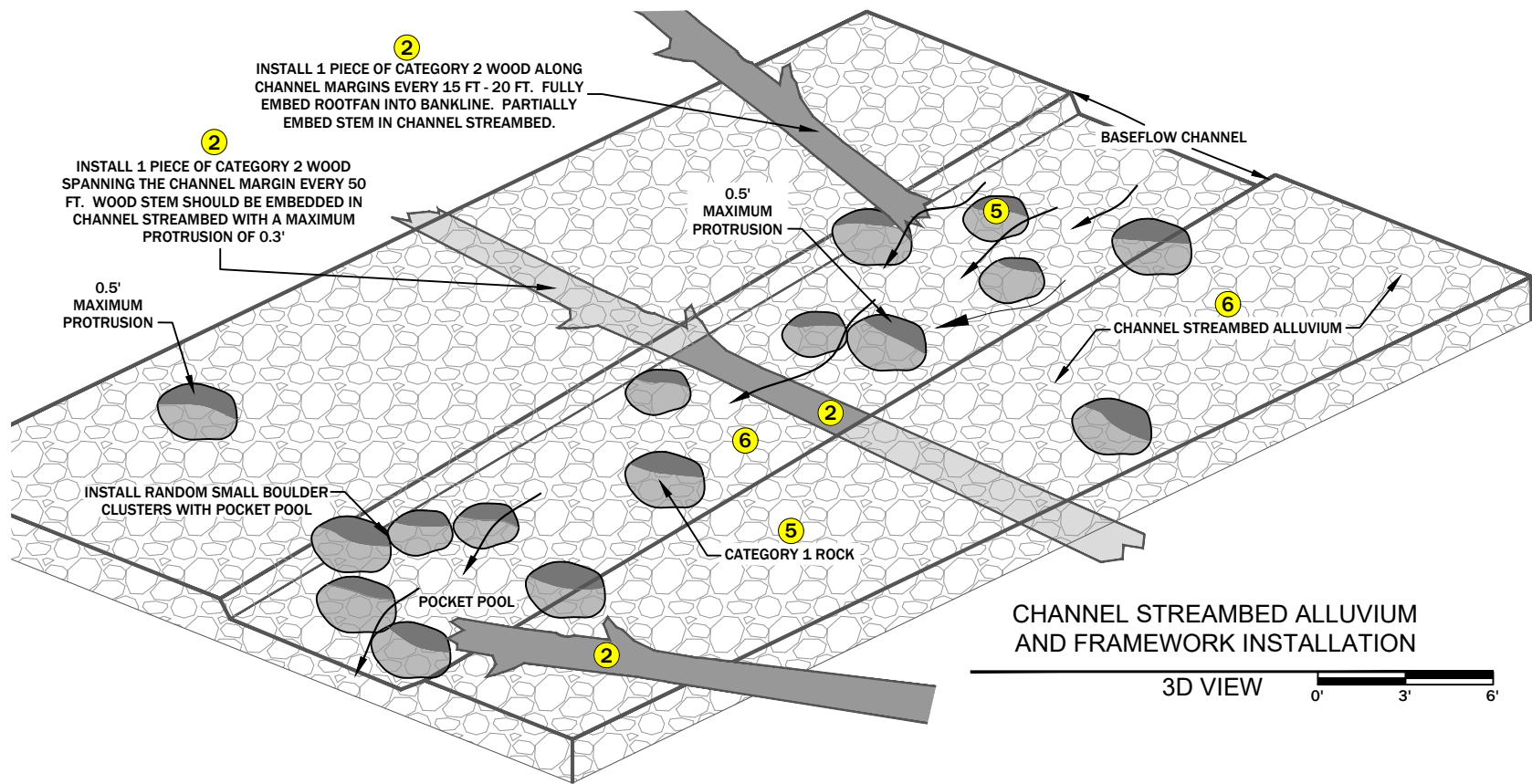
	ITEM	DIA.	TYPE 1	QUANTITY		
				TYPE 2	TYPE 3	
2	CATEGORY 2 WOOD	6" - 12"	0.5	2	-	
3	CATEGORY 3 WOOD	< 3"	1	3	1	
4	WILLOW CUTTINGS	0.25" - 1"	7	7	7	
5	STREAMBANK ALLUVIUM	8" MINUS	0.11 CY	0.2 CY	-	



WILLOW TRENCH DETAIL
PLAN VIEW
0' 1' 2'



RECOMMENDED VEGETATED WOOD MATRIX
INSTALLATION SEQUENCE
SECTION VIEW
0' 2.5' 5'



TYPICAL CONSTRUCTED STREAMBED THROUGH A RIFFLE FEATURE



TYPICAL CONSTRUCTED STREAMBED THROUGH A RUN FEATURE

GENERAL NOTES

1. CONSTRUCTION OF THE CHANNEL STREAMBED WILL OCCUR AFTER THE CHANNEL SUBGRADE IS PREPARED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE CONSTRUCTION MANAGER.
3. IT IS THE CONTRACTORS RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
4. CONTRACTOR SHALL MARK THE UPSTREAM AND DOWNSTREAM EXTENTS OF THE LOCATIONS OF THE CONSTRUCTED CHANNEL STREAMBED STRUCTURES.

NOTES ON CONSTRUCTED CHANNEL STREAMBED INSTALLATION

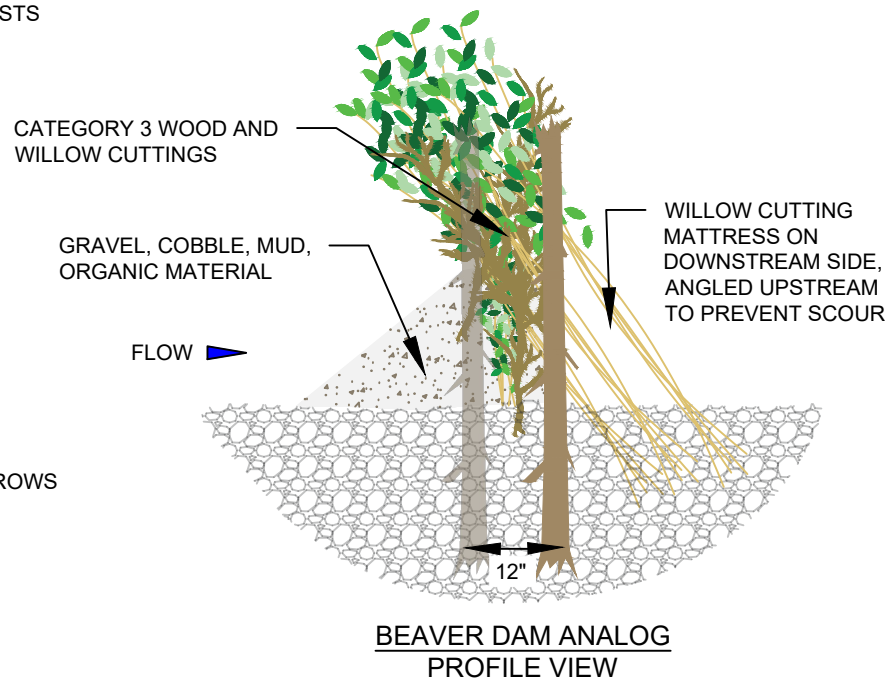
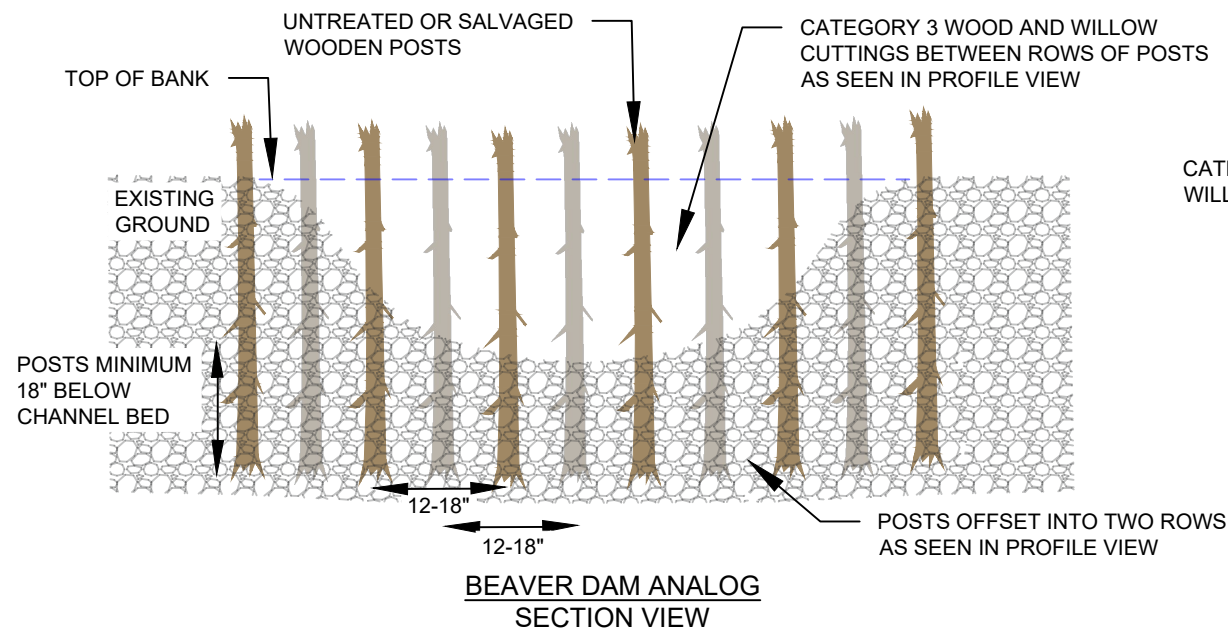
1. PRIOR TO CONSTRUCTION OF THE CHANNEL STREAMBED, CONSTRUCTION MANAGER SHALL VERIFY CHANNEL SUBGRADE ELEVATIONS. CHANNEL SUBGRADE SERVES AS THE FOUNDATION FOR THE CONSTRUCTED CHANNEL STREAMBED.
2. CONTRACTOR SHALL STOCKPILE CHANNEL ALLUVIUM PER SPECIFICATIONS NOTED ON THE DRAWING.
3. PREPARE THE FRAMEWORK. CONTRACTOR SHALL PLACE 12-INCH TO 18-INCH BOULDERS (CATEGORY 1 ROCK) ON THE SURFACE OF THE CHANNEL SUBGRADE PRIMARILY WITHIN THE LOW FLOW CHANNEL AS INDICATED ON THE DRAWING. DUE TO THE INHERENT VARIABILITY IN MATERIALS, BOULDER ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE WILL BE NO GREATER THAN 0.5-FT.
4. CONTRACTOR MAY INSTALL 12-INCH TO 18-INCH BOULDERS (CATEGORY 1 ROCK) IN CLUSTERS, AS DIRECTED BY THE CONSTRUCTION MANAGER, TO CREATE A COMPLEX SERIES OF POCKET POOLS THAT EFFECTIVELY DISSIPATE ENERGY AND PROVIDE PATHWAYS FOR FISH MOVEMENT. BOULDER ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE IS NO GREATER THAN 0.5-FT.
5. CONTRACTOR SHALL INSTALL CHANNEL SPANNING WOOD (CATEGORY 2 WOOD) AND CHANNEL MARGIN WOOD (CATEGORY 2 WOOD) TO PROVIDE AQUATIC HABITAT COMPLEXITY AND ROUGHNESS. CHANNEL SPANNING WOOD SHALL BE INSTALLED INTO THE BED PERPENDICULAR TO FLOW WITH A MAXIMUM PROJECTION OF 0.3'. CHANNEL MARGIN WOOD SHALL PROJECT NO GREATER THAN 8 FEET INTO THE CONSTRUCTED STREAMBED IN VARIOUS ORIENTATIONS TO FLOW, AS DIRECTED BY CONSTRUCTION MANAGER. CHANNEL MARGIN WOOD SHALL BE EMBEDDED INTO THE CHANNEL STREAMBED A MINIMUM OF ONE-HALF THE LOG DIAMETER, AS SHOWN ON THE DRAWINGS.
6. PREPARE THE MATRIX. AFTER THE FRAMEWORK, WOOD, BOULDER CLUSTERS, AND SMALL BOULDER RIBS ARE INSTALLED AND INSPECTED BY CONSTRUCTION MANAGER, PLACE APPROPRIATE CHANNEL STREAMBED ALLUVIUM GRADATION AND WASH FINES INTO STREAMBED. CHANNEL STREAMBED ALLUVIUM SHALL BE PLACED TO THE FULL COURSE THICKNESS OF 12-INCHES TO FINISHED GRADE.

STREAMBED ALLUVIUM GRADATION

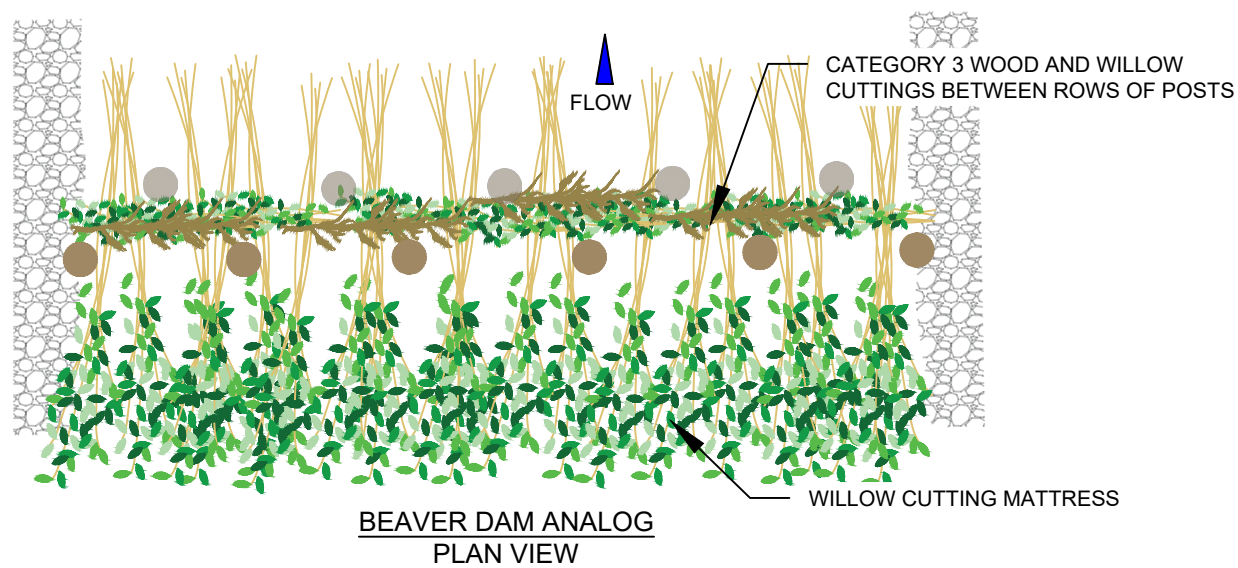
SIZE (INCHES)	PERCENT PASSING
8	95
7	80 - 90
6	65 - 75
4	45 - 60
2	35 - 40
1	25 - 30
0.6	20

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIA.	QUANTITY
5	CATEGORY 1 ROCK	12" - 18"	0.5 EA
6	CHANNEL STREAMBED ALLUVIUM	8" MINUS	0.8 CY
2	CATEGORY 2 WOOD	6" - 12"	0.08 EA



BEAVER DAM ANALOG MATERIAL SCHEDULE		
ITEM	DIMENSIONS	QUANTITY/ LINEAR FOOT
UNTREATED OR SALVAGED WOODEN POSTS	3" D, 4' L	1 EACH
CATEGORY 3 WOOD	<3" D, 4'-8' L	3 PIECES
WILLOW CUTTINGS	0.5"-1" D, 4'-6' L	5
GRAVEL/COBBLE/MUD	VARIES	0.4 CY

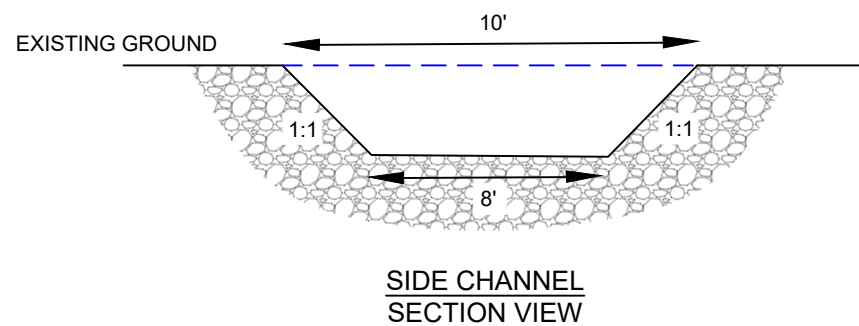


NOTES ON BEAVER DAM ANALOG CONSTRUCTION

1. INSTALL TWO ROWS OF POSTS SPANNING THE WIDTH OF THE CHANNEL, POSTS MAY BE DRIVEN IN WITH A POST POUNDER OR EQUIVALENT TOOL. SPACE ROWS 12 IN APART. SPACE POSTS IN EACH ROW APPROXIMATELY 12-18 IN APART AND ENSURE THAT AT LEAST ONE ROW OF POSTS HAS ONE POST INSTALLED IN THE BANK OF THE CHANNEL. POSTS SHOULD BE DRIVEN A MINIMUM OF 18 IN BELOW THE BED OF THE CHANNEL.
2. INSTALL BRUSH (GREEN CONIFER BRANCHES PREFERRED) AND LIVE WILLOW CUTTINGS IN THE 12 IN SPACE BETWEEN THE TWO ROWS OF POSTS. INSTALL BRUSH AND CUTTINGS IN 0.5 FT LAYERS AND COMPACT EACH LAYER AFTER INSTALLATION.
3. PRIOR TO INSTALLING THE FINAL LAYER (0.5 FT) OF BRUSH, INSTALL A MATTRESS OF WILLOW CUTTINGS ON THE DOWNSTREAM SIDE OF THE BEAVER HABITAT STRUCTURE. ORIENT CUTTINGS IN AN UPSTREAM DIRECTION WITH THE CUT ENDS BURIED INTO THE CHANNEL BED AND THE BRANCH TIPS EXTENDING UPSTREAM AND ON TOP OF THE LAST PLACED LAYER OF BRUSH BETWEEN THE POSTS. INSTALL THE FINAL LAYER OF BRUSH BETWEEN THE POSTS ON TOP OF THE WILLOW MATTRESS CUTTINGS TO SECURE THEM.
4. INSTALL A WEDGE OF COBBLE, GRAVEL, MUD AND ORGANIC MATTER ALONG THE UPSTREAM ROW OF POSTS. MATERIAL CAN BE EXCAVATED FROM THE CHANNEL BED DOWNSTREAM OF THE STRUCTURE. COMPACT MATERIAL TO ENSURE GOOD CONTACT WITH THE POSTS, BRUSH, CHANNEL BED AND CHANNEL BANKS.

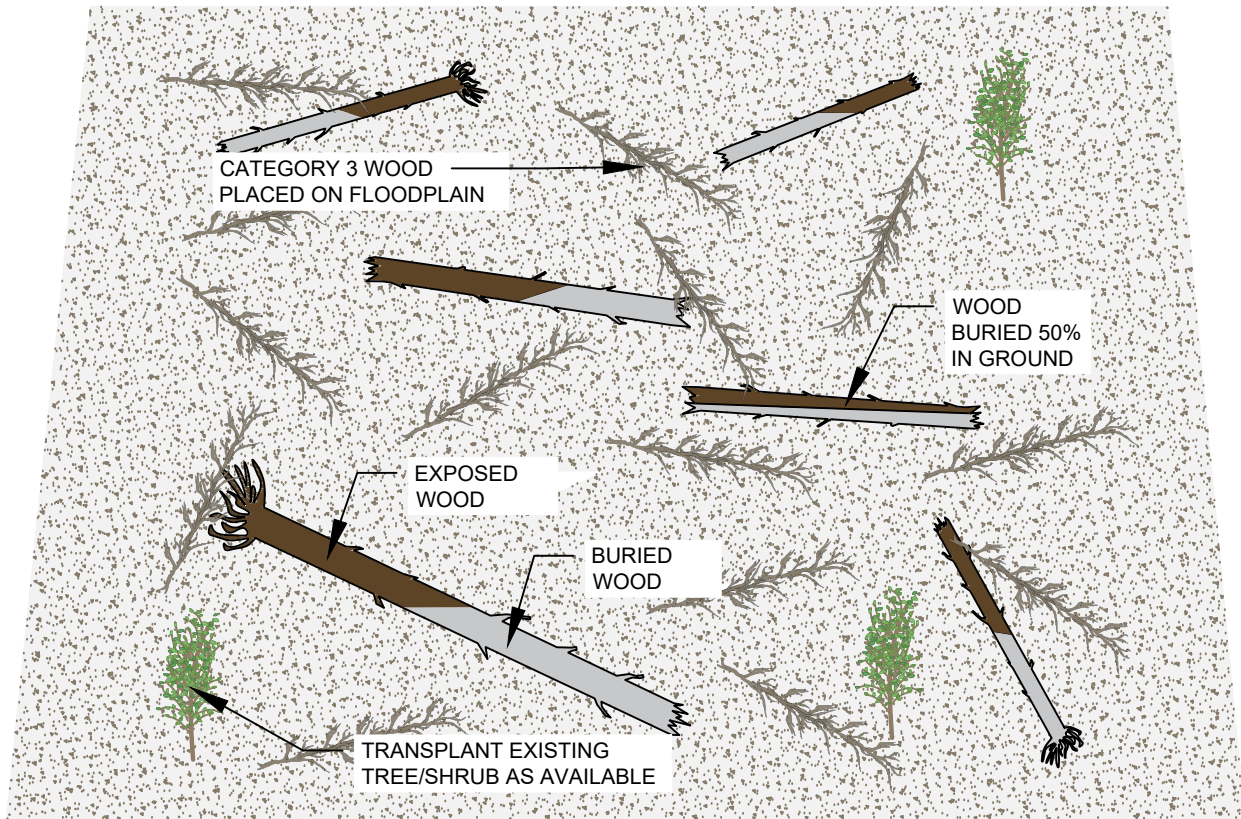
NOTES ON SIDE CHANNEL CONSTRUCTION

1. CONTRACTOR SHALL EXCAVATE FLOODPLAIN SIDE CHANNELS TO FINISHED GRADE ELEVATIONS AND ALIGNMENTS SHOWN ON THE DRAWINGS.
2. SIDE CHANNEL CONSTRUCTION WILL CONSIST OF EXCAVATING A 1' DEEP CHANNEL WITH SIDE SLOPES OF 1:1 THROUGH FLOODPLAIN TREATMENT OR EXISTING GROUND LOCATIONS.
3. SIDE CHANNELS WILL CONTAIN BEAVER DAM ANALOGS TO BE CONSTRUCTED ACROSS THE CHANNEL AFTER SIDE CHANNEL CONSTRUCTION IS COMPLETE.

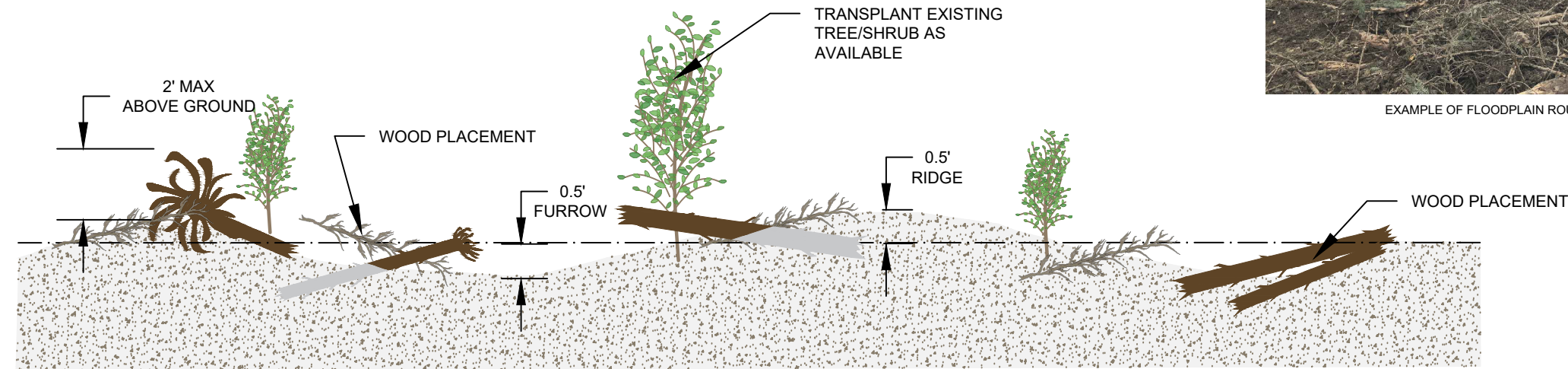


BEAVER DAM ANALOG AND SIDE CHANNEL DETAIL

LOLO CREEK - ZENS RESTORATION PROJECT
 LOLO, MONTANA



FLOODPLAIN TREATMENT
PLAN VIEW



FLOODPLAIN TREATMENT
SECTION VIEW

NOTES ON FLOODPLAIN TREATMENT CONSTRUCTION

1. FLOODPLAIN TREATMENT LOCATIONS WILL BE STAKED BY THE ENGINEER PRIOR TO CONSTRUCTION.
2. CONSTRUCT THE FLOODPLAIN ROUGHNESS BY CREATING MICRO-TOPOGRAPHY CONSISTING OF LOW AND HIGH FEATURES (RIDGES AND FURROWS), WITH NO DISCERNABLE PATTERN (I.E NO ROWS), OVER THE ENTIRE LOWERED FLOODPLAIN AREA. MAXIMUM DEVIATION FROM THE DESIGNED FINISHED GRADE WILL BE NO MORE THAN 0.5 FEET.
3. PLACE WOODY MATERIAL TO CREATE ADDITIONAL ROUGHNESS IN THE FLOODPLAIN SURFACE. BURY THE WOOD PARTIALLY IN THE FLOODPLAIN WITH ONE HALF OF THE LENGTH BURIED TO A DEPTH OF TWO FEET. PLACE WOOD AT THE RATE SPECIFIED IN THE MATERIAL SCHEDULE.
4. UTILIZE WOOD MEETING THE DIMENSIONS SHOWN IN THE MATERIAL SCHEDULE. CUT THE WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT SPECIFIED DIMENSIONS.
5. LOAD AND HAUL WOOD FROM THE STAGING AREAS TO THE TREATMENT LOCATIONS. HAUL AND STAGE THE WOOD AT THE INSTALLATION LOCATIONS IN A MANNER THAT PRESERVES THE SIZE, TYPE, AND INTEGRITY OF EACH PIECE TO BE INCORPORATED INTO THE WORK. HANDLE MATERIALS IN A MANNER THAT MINIMIZES DAMAGE TO BARK, LIMBS, AND ROOTWADS IF PRESENT (NO ROLLING, CRUNCHING, CRUSHING, ETC.).

MATERIAL SCHEDULE (PER ACRE)		
ITEM	DIMENSION	QUANTITY
CATEGORY 2 WOOD	6"-12" D, 6-8' MIN. L	25 PIECES
CATEGORY 3 WOOD	<3" D, 4'-8' L	15 PIECES



EXAMPLE OF FLOODPLAIN ROUGHNESS AND WOOD PLACEMENT

FLOODPLAIN TREATMENT DETAIL

LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA

DRAWN BY: GEUM AND RDG
DESIGNED BY: GEUM AND RDG
DATE: NOVEMBER 2020

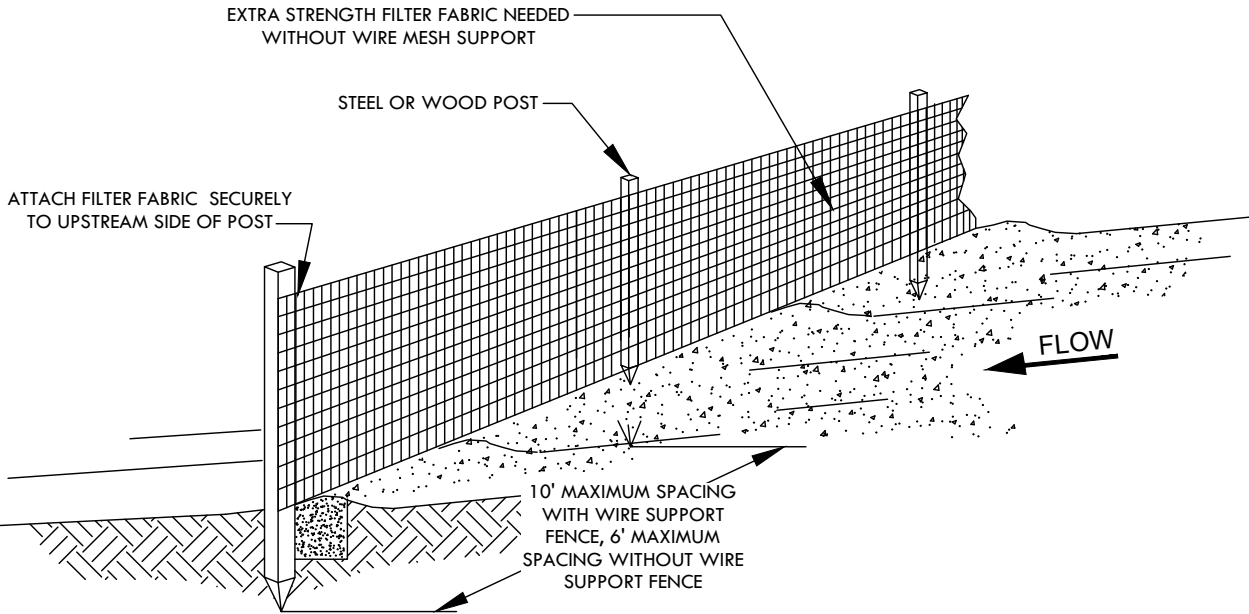
SHEET
7.5

SEDIMENT FENCE GENERAL NOTES

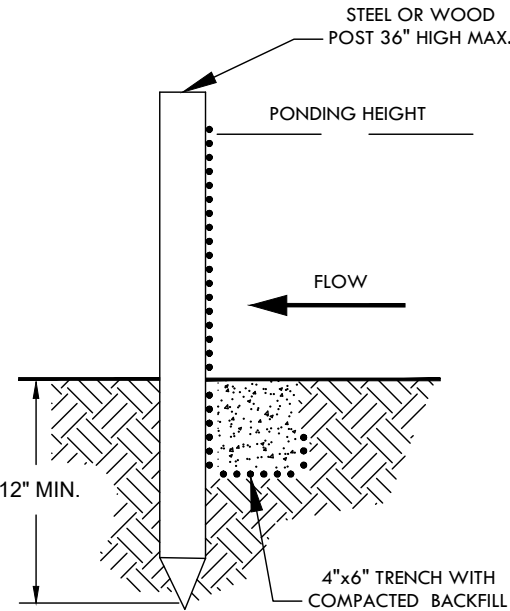
1. THE HEIGHT OF A SEDIMENT FENCE SHALL NOT EXCEED 36 INCHES. STORAGE HEIGHT AND PONDING HEIGHT SHALL NEVER EXCEED 18 INCHES.
2. THE FENCE LINE SHALL FOLLOW THE CONTOUR AS CLOSELY AS POSSIBLE.
3. IF POSSIBLE, THE FILTER FABRIC SHALL BE CUT FROM A CONTINUOUS ROLL TO AVOID THE USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPLICED ONLY AT A SUPPORT POST, WITH A MINIMUM 6 INCH OVERLAP AND BOTH ENDS SECURELY FASTENED TO THE POST.
4. POSTS SHALL BE SPACED A MAXIMUM OF 10 FEET APART AND DRIVEN SECURELY INTO THE GROUND (MINIMUM OF 12 INCHES. WHEN EXTRA-STRENGTH FABRIC IS USED WITHOUT THE WIRE SUPPORT FENCE, POST SPACING SHALL NOT EXCEED 6 FEET.
5. TURN THE ENDS OF THE FENCE UPHILL.
6. A TRENCH SHALL BE EXCAVATED APPROXIMATELY 4 INCHES WIDE AND 6 INCHES DEEP ALONG THE LINE OF POSTS AND UPSLOPE FROM THE BARRIER.
7. WHEN STANDARD-STRENGTH FILTER FABRIC IS USED, A WIRE MESH SUPPORT FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY DUTY WIRE STAPLES AT LEAST 1INCH LONG, TIE WIRES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 2 INCHES AND SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
8. THE STANDARD-STRENGTH FILTER FABRIC SHALL BE STAPLED OR WIRED TO THE FENCE, AND 6 INCHES OF THE FABRIC SHALL EXTEND INTO THE TRENCH. THE FABRIC SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE. FILTER FABRIC SHALL NOT BE STAPLED TO EXISTING TREES.
9. WHEN EXTRA-STRENGTH FILTER FABRIC AND CLOSER POST SPACING ARE USED, THE WIRE MESH SUPPORT FENCE MAY BE ELIMINATED. IN SUCH A CASE, THE FILTER FABRIC IS STAPLED OR WIRED DIRECTLY TO THE POSTS.
10. THE TRENCH SHALL BE BACKFILLED AND THE SOIL COMPACTED OVER THE TOE OF THE FILTER FABRIC.
11. SEDIMENT FENCES PLACED AT THE TOE OF A SLOPE SHALL BE SET AT LEAST 6 FEET FROM THE TOE IN ORDER TO INCREASE PONDING VOLUME.
12. SEDIMENT FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY STABILIZED AND ANY SEDIMENT STORED BEHIND THE SEDIMENT FENCE HAS BEEN REMOVED.

INSPECTION AND MAINTENANCE:

1. SEDIMENT FENCES AND FILTER BARRIERS SHALL BE INSPECTED WEEKLY AFTER EACH SIGNIFICANT STORM (0.25 INCH IN 24 HOUR). ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.
2. SEDIMENT SHOULD BE REMOVED WHEN IT REACHES 1/3 HEIGHT OF THE FENCE OR 9 INCHES MAXIMUM.
3. THE REMOVED SEDIMENT SHALL CONFORM WITH THE EXISTING GRADE AND BE VEGETATED OR OTHERWISE STABILIZED.



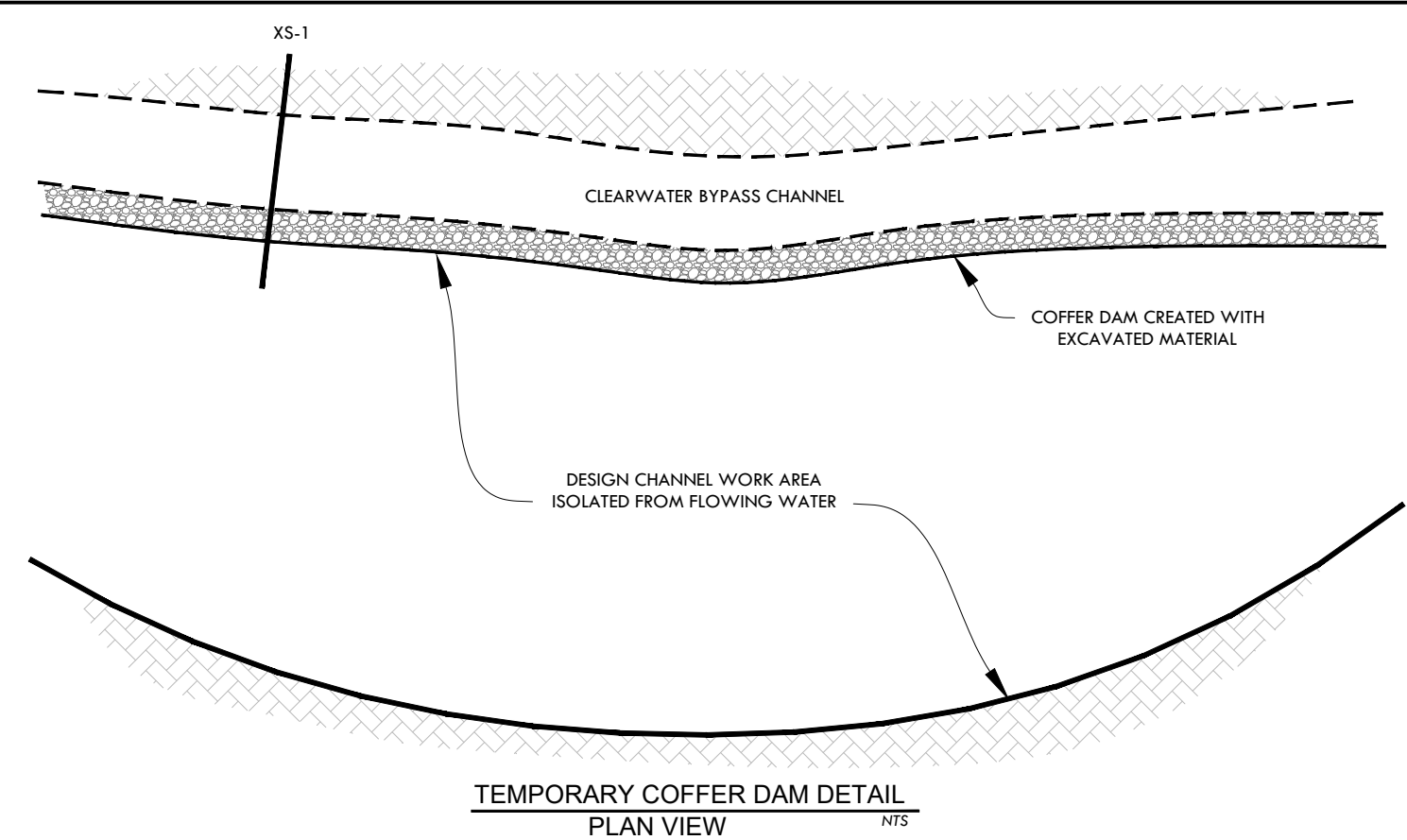
SEDIMENT FENCE
DETAIL NTS



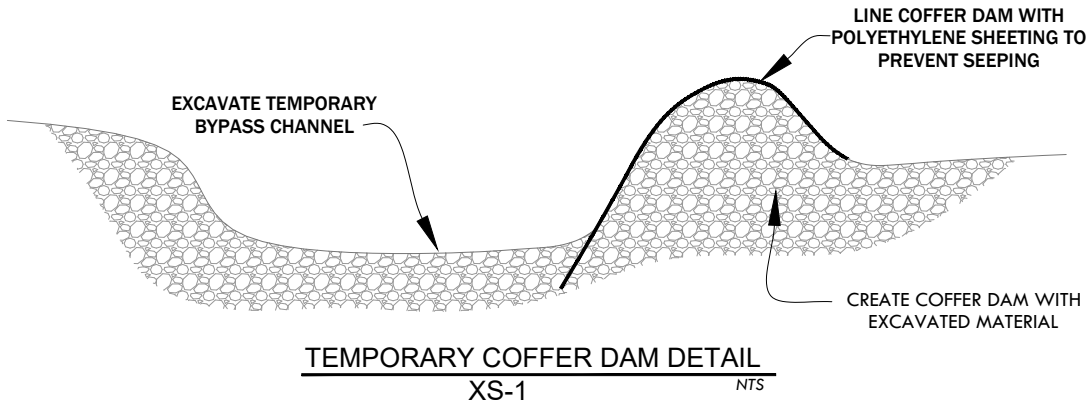
TRENCH DETAIL

ADDITIONAL NOTES:

1. SEDIMENT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" MAXIMUM RECOMMENDED STORAGE HEIGHT.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.



TEMPORARY COFFER DAM DETAIL
PLAN VIEW NTS



TEMPORARY COFFER DAM DETAIL
XS-1 NTS



DATUM: NAD 83
PROJECTION: MT SP
UNITS: US FOOT
DATA SOURCES:

BMP DETAILS

LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA

DRAWN BY: GEUM AND RDG
DESIGNED BY: GEUM AND RDG
DATE: NOVEMBER 2020

SHEET
8.0

TREATMENT QUANTITIES		
	UNITS	ESTIMATED QUANTITY
MAIN CHANNEL REALIGNMENT	LINEAR FEET	2,400
SIDE CHANNEL CONSTRUCTION	LINEAR FEET	1,348
DISTRIBUTARY CHANNEL ACTIVATION	LINEAR FEET	3,750
LARGE WOOD STRUCTURE	EACH	8
CHANNEL FILL AND WETLAND CREATION	ACRES	0.86
WETLAND ENHANCEMENT AND RESTORATION	ACRES	2.55
ALCOVE PRESERVATION	ACRES	0.20
CONSTRUCTED CHANNEL STREAMBED	LINEAR FEET	1,837
VEGETATED WOOD MATRIX TYPE 1	LINEAR FEET	1,988
VEGETATED WOOD MATRIX TYPE 2	LINEAR FEET	1,436
VEGETATED WOOD MATRIX TYPE 3	LINEAR FEET	1,390
BEAVER DAM ANALOG	EACH	17
FLOODPLAIN TREATMENT	ACRES	2.74

MATERIALS LIST	UNITS	ESTIMATED QUANTITY
WOOD		
CATEGORY 1 WOOD (12"-18" x 25')	EACH	48
CATEGORY 2 WOOD (6"-12" x 10-12')	EACH	4,130
CATEGORY 3 WOOD (<3" x 8-12')	EACH	8,357
WOODEN POST	EACH	170
ROCK		
CATEGORY 1 ROCK (12"-18")	CUBIC YARD	919
NATIVE ALLUVIUM (8" MINUS)	CUBIC YARD	1,975
GRAVEL/COBBLE/MUD	CUBIC YARD	68
OTHER		
WILLOW CUTTINGS (0.25-1" x 8')	EACH	36,149
CONTAINERIZED PLANTS	EACH	500
NATIVE SEED	POUNDS	25



DATUM: NAD 83
PROJECTION: MT SP
UNITS: US FOOT
DATA SOURCES:

MATERIALS AND QUANTITIES

LOLO CREEK - ZENS RESTORATION PROJECT
LOLO, MONTANA

DRAWN BY: GEUM AND RDG
DESIGNED BY: GEUM AND RDG
DATE: NOVEMBER 2020



LOLO CREEK ZENS RESTORATION PROJECT COST ESTIMATE

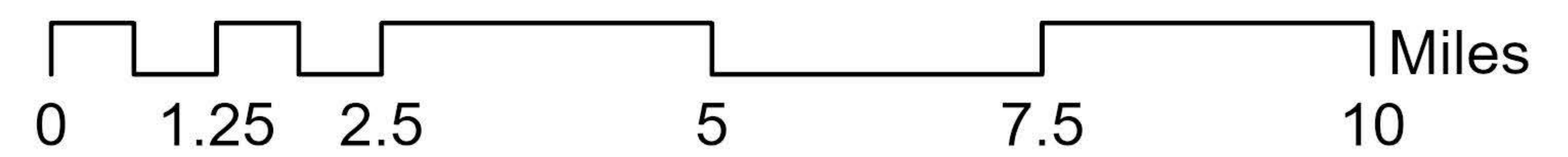
Prepared by A. Sacry (Geum) and J. Muhlfeld (River Design Group), 11/5/2020

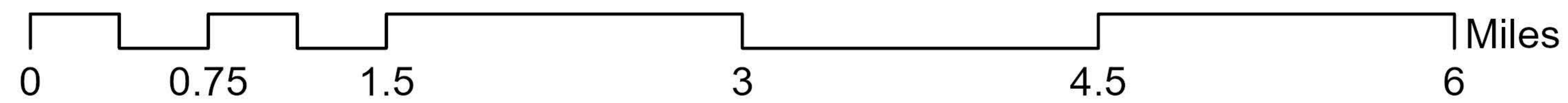
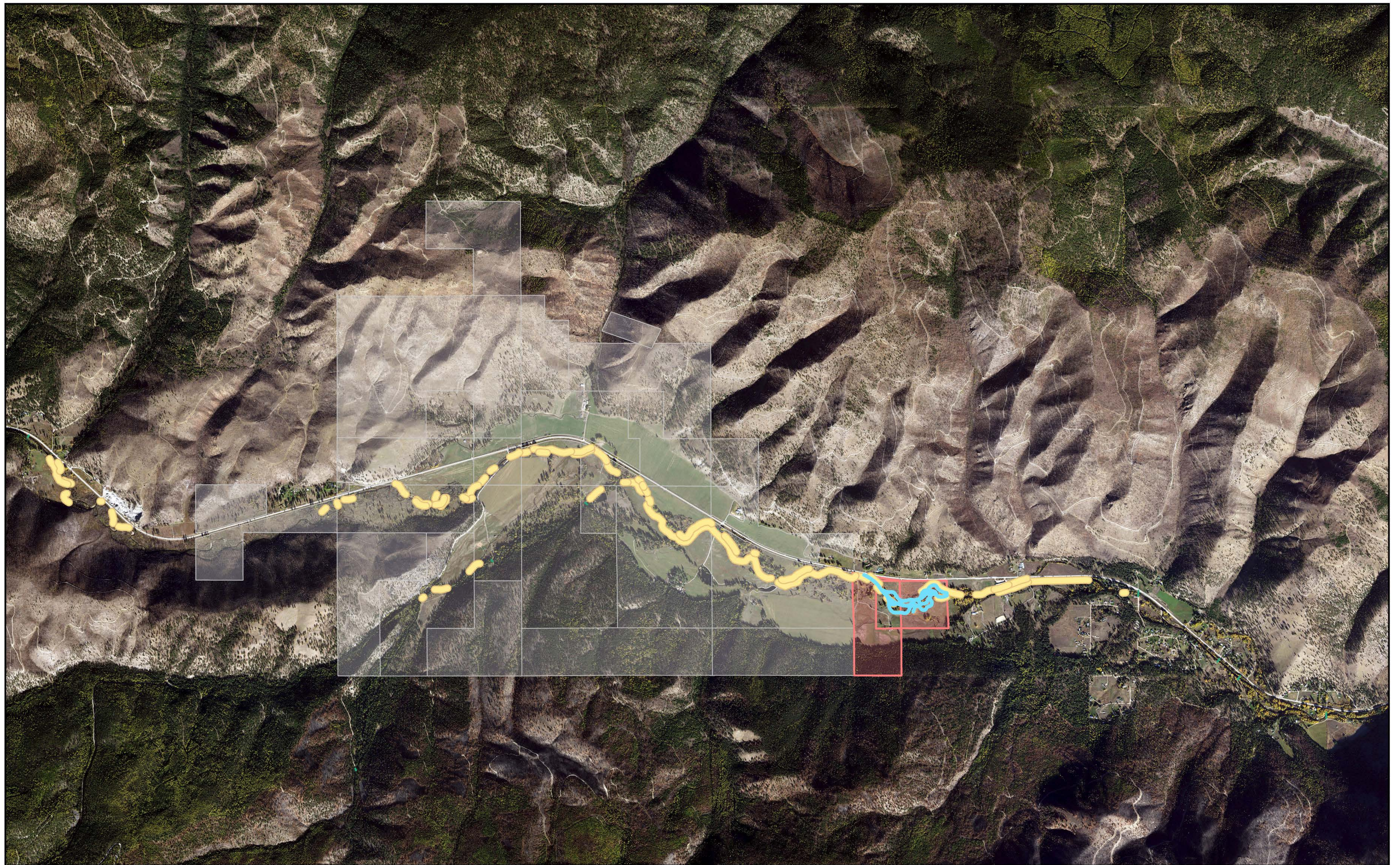


ESTIMATED CONSTRUCTION COSTS	Unit	Estimated Quantity	Estimated Unit Cost	Total Estimated Cost
1. Mobilization, GPS Equipment, Crew Per Diem	lump sum	1	\$15,000.00	\$15,000.00
2. Clear and Grub	lump sum	1	\$2,500.00	\$2,500.00
3. Clearwater Diversions, Water Management, BMPs	lump sum	1	\$2,500.00	\$2,500.00
4. Salvage, Preserve and Transplant Existing Vegetation	lump sum	1	\$2,500.00	\$2,500.00
5. Construct and Improve Roads and Staging Areas	lump sum	1	\$1,500.00	\$1,500.00
6. Construct Channel Streambed Station 3+00 to 14+00, 22+00 to 27+00	linear feet	1,600	\$40.00	\$64,000.00
7. Shape and Enhance Channel Streambed Station 14+00 to 22+00	linear feet	800	\$22.00	\$17,600.00
8. Furnish Wood	lump sum	1	\$15,000.00	\$15,000.00
9. Furnish Streambed and Streambank Alluvium (On Site)	cubic yard	1,958	\$20.00	\$39,160.00
10. Furnish Rock (12-18")	cubic yard	919	\$15.00	\$13,785.00
11. Construct Side Channels	linear feet	1,348	\$3.00	\$4,044.00
12. Construct Large Wood Structures	each	8	\$1,250.00	\$10,000.00
13. Construct Woody Debris Matrix Streambank Treatment Type 1	linear feet	1,988	\$20.00	\$39,760.00
14. Construct Woody Debris Matrix Streambank Treatment Type 2	linear feet	1,348	\$12.00	\$16,176.00
15. Construct Woody Debris Matrix Streambank Treatment Type 3	linear feet	1,390	\$3.00	\$4,170.00
16. Beaver Dam Analogs in Side Channels	each	17	\$150.00	\$2,550.00
17. Willow Cuttings	each	35,000	\$0.25	\$8,750.00
18. Floodplain Treatment (topography, woody debris, willow trenches)	acres	2.74	\$1,500.00	\$4,110.00
19. Wetland Enhancement	acres	2.55	\$1,500.00	\$3,825.00
20. Seeding	acres	5	\$100.00	\$500.00
21. Containerized Plant Installation	each	500	\$8.50	\$4,250.00
				\$271,680.00
Construction Management (7.5% of estimated Total Construction Cost)	lump sum	1	\$20,376.00	\$20,376.00
			TOTAL Estimated Construction Cost	\$292,056.00



Grazing and Crops Along Streambanks in
Middle Lolo Creek





Crop and Grazing Along Streambanks in Middle Lolo Creek

Sources:
USGS The National Map:Orthoimagery
MTDEQ Watershed Protection Section
Cadastral
Map Created by Heather Brighton
Lolo Creek Watershed Group